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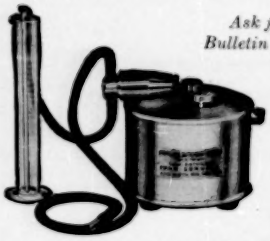

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THE QUARTERLY REVIEW of BIOLOGY

HYBRIDS AND HISTORY. THE ROLE OF RACE AND ETHNIC CROSSING IN INDIVIDUAL AND NATIONAL ACHIEVEMENT

BY GEORGE D. SNELL

Roscoe B. Jackson Memorial Laboratory, Bar Harbor, Maine

IT is curious to reflect that almost the requisite three or four hundred years have passed since the intercrossing began in America; and it is possible that the United States of America may be quite near to a brilliant efflorescence of genius in thought and art, and perhaps even more in the scientific organization of natural resources for the good of its own life and for the life of mankind" (Murphy, 1941).

This quotation from a British author is based on a phenomenon often noted by anthropologists and historians. Sir Flinders Petrie (1911) and numerous writers after him have remarked that the rise of great civilizations, usually and perhaps invariably, is preceded by a mixing of races, and that an incubation period of several centuries follows the first invasion of alien groups before the civilization comes to full flower.

Toynbee (1935) has attached less significance to the crossing than most writers, and his discussion of the subject may be taken as conservative. He distinguishes twenty-one civilizations, and finds clear evidence of crossing in eleven of these. Moreover, most of the remaining ten can also be said to involve crossing if some additional permissible divisions are made in the races of man. The ten civilizations in which the evidence of crossing is least clear are the Babylonic, Syriac, Arabic, Hindu, Sinic (yellow), Far Eastern (yellow), Andean, Mayan, Yucatec, and Mexican. Nine of the great white civilizations including the Hellenic, Western and Egyptic are known beyond question to be the product of hybrid peoples with the Alpine race being one of the components of the mixture and the Nordic and/or Mediterranean the other. Toynbee concludes that "the number of civilizations created by the unaided endeavours of a single race in each case would present themselves as exceptions to a prevalent law—a law to the effect that the geneses of civilizations require creative contributions from more races than one."

There has been little agreement among those who have discussed the subject as to reason for this relation between race crossing and the progress of civilizations. It is the purpose of this paper to examine the possibility that race crossing, even between subgroups of the white race, produces individuals of exceptional vitality and vigor (hybrid vigor), and that its role in the development of civilizations lies largely or in significant part in the unusual contributions which these individuals, both as leaders and as laborers, are able to make. Few writers seem to have considered this possibility. Hooton (1926) has recognized the probable occurrence of heterosis within the white race, and Hankins (1926) has proposed heterosis as an explanation of the role of race mixture in the genesis of civilizations. Other writers have looked elsewhere in seeking to explain the phenomenon.

This paper is concerned exclusively with the

biological effects of race crossing, and particularly with the effects in the early hybrid generations. Nothing that is said here is intended as an expression of opinion on the sociological consequences or on the advisability or inadvisability of the wider race crosses.

THE EFFECTS OF HYBRID VIGOR IN ANIMALS OTHER THAN MAN

It has long been known that crosses between unrelated varieties or species yield offspring of exceptional vigor. Darwin made extensive tests of the phenomenon in plants, and wrote about it (1876) in "The Effects of Cross and Self-fertilization in the Vegetable Kingdom." The remarkable increase in corn yield in this country in recent years due to the introduction of hybrid corn is common knowledge. For our purposes the most instructive work in cross-breeding is some that has been done with swine. While some of the most precise experiments have been carried out with guinea pigs and other laboratory animals, these are less applicable because the strains used, unlike human races, had been highly inbred. For selecting the lowly pig as an object of comparison, we owe an apology to our illustrious subjects. Nevertheless, in all honesty, we cannot say that any resemblance is purely coincidental.

Ohio has been the scene of some of the most extensive tests. Dr. W. L. Robison (1948) carried out crosses at four separate Ohio farms. Three breeds of pigs were used, the Poland China, the Hampshire and the Duroc Jersey, sires from these breeds being used in rotation. The sows in the first generation, thus, were purebreds but their offspring hybrids; in the second and later generations, which provided most of the data, both dams and their litters were hybrid. At each farm one of the purebred strains was maintained to serve as a basis of comparison. In terms of the percent advantage of crossbred over purebred, some of the pooled results were as follows: number of live pigs per litter at birth, 13.2 per cent advantage for the crossbreds; number of pigs per litter at weaning, 11.7 per cent advantage; weight per pig at 56 days, 10.9 per cent advantage; weight per pig at 180 days, 11.3 per cent advantage. At one farm data were also kept on the efficiency of feed utilization. These showed that the hybrids required 7.9 per cent less feed than the purebreds to reach 220 lbs. average weight.

Other investigators (Hutton and Russell, 1939; Headley, 1940; Lush, Shearer, and Culbertson, 1939; Winters et al., 1943 and 1944) have obtained similar, though probably because of the smaller scale of most of the studies, less consistent results. Crossbreds as compared with the purebreds have shown anything from infrequent slight disadvantages to advantages which range from 10 to 20 or even 37 per cent. The study by Winters and coworkers (1944) sheds light on certain interesting details of the effect of crossing. To measure hybrid vigor they used an index compounded of 1, number of pigs born alive, 2, survival, birth to weaning, 3, rate of gain to 180 days, and 4, economy of feed use. In the first generation the dams were purebred, the offspring hybrid. These crosses showed an advantage of 6.3 per cent over the average of the parent breeds. If the first generation hybrid females were backcrossed to one of the parent breeds the advantage was 7.5 per cent. In this cross the mother was a first generation hybrid, but the offspring belonged to a segregating (backcross) generation and hence averaged less than maximum hybrid vigor. In a third type of test, first generation hybrid females were mated to males of a third breed. In this cross in which both dams and their litters should have maximum hybrid vigor the advantage over the average of the pure breeds was 11.7 per cent. The similarity of this figure to those obtained by Robison for three breed crosses is notable.

In another test Winters used ten partly inbred lines of swine, seven from the Poland China breed, three from other breeds. These crosses show in a remarkable way the effect of prior inbreeding and of the width of the cross on the degree of heterosis produced. When the Poland China strains were crossed among themselves the advantage of the hybrids over their parents was 10.6 per cent. When the inbred strains crossed came from separate breeds the advantage of the hybrids jumped to 19.9 per cent. When a mathematical measure of inbreeding was applied to the crosses it was found that the decrease in inbreeding, and hence in homozygosity, showed a clear proportionality to the increase in vigor.

Experiments by Wright and Lewis (1921) with crosses of inbred strains of guinea pigs add one other point of interest. These authors found resistance to tuberculosis to be increased in the hybrids.

THEORETICAL EXPECTATIONS

While it has long been known that crosses between unrelated varieties or species yield offspring of exceptional vigor, it was not until 1917, when Jones published a theory based on the dominance of linked factors, that the phenomenon was successfully explained. This theory, and a modification proposed by East, are described in most genetics text books and a further discussion would be out of place here. Whaley (1944) and Henderson (1949), among others, have reviewed the literature. Dobzhansky and coworkers (1942) have published some particularly illuminating experimental evidence.

While we shall not discuss Jones's theory, there are certain deductions from it that are pertinent to our subject. It is necessary in the first place to emphasize the distinction between the F_1 or first generation hybrid and the hybrids of the later or segregating generations. The differences are twofold. First, the F_1 hybrids are as uniform, on the average, as the parent races, while the F_2 hybrids manifest increased variability. Second, it is only in the F_1 that maximum heterosis or hybrid vigor is found. There is a sharp decrease in the later generations.

The extent of this decrease depends on a variety of factors, some of which, in the case of man, cannot be precisely evaluated. It will be illuminating, however, to consider the results expected from genetic theory when certain simplifying assumptions are made.

If an F_1 individual marries back into one of the parental strains, the offspring (first backcross generation) show, on the average, a degree of heterosis just midway between the F_1 and the parent race (effect of factors for vigor assumed to be additive). In a second backcross generation the heterosis is reduced from 50 per cent to 25 per cent as compared with the F_1, in a third backcross to 12.5 per cent and so on. It thus rapidly approaches the level of the parent race.

In a population in which hybrid individuals marry among themselves a different condition prevails. In an F_2 generation produced by intermarriage of F_1's, there is again a drop to an average level midway between the F_1 and the parent races. Whether subsequent generations of an intermarrying hybrid population will show a further decrease in vigor depends on a number of factors, the most important of which is the degree of inbreeding. If (1) the degree of inbreeding were the same as in the parent races, (2) there were no selection, and (3) there were no mutations, the average vigor could remain indefinitely at the 50 per cent level, midway between the F_1 and the parent races. Actually these conditions are never fully met, but the possibility of the retention of considerable heterosis in the later hybrid generations deserves emphasis.

THE WIDER CROSSES IN MAN

Many of the data on the wider crosses in man lack pertinence to our discussion because they deal with the segregating generations instead of with the F_1 hybrid. As already pointed out, hybrid vigor may be expected to fall off by 50 per cent in the F_2. If subsequent inbreeding occurs it will decline still further.

Fortunately there is one instance of crossing in man where the data are quite complete. This is the cross between the *Bounty* mutineers and the Polynesian women who accompanied them from Tahiti to Pitcairn Island. Of the 9 English mutineers led by Christian to this island retreat in 1789, 6 apparently left children. Accounts differ as to the number of Tahitian females, but there were probably about 12. Some 66 years after the founding of the colony, the bulk of the population was permanently removed to Norfolk Island where Shapiro (1929) carried out a detailed study. Throughout all this period there was a negligible introduction of other blood. The data include not only Shapiro's own observations, but some reliable older records, including some measurements of the islanders made by Beechey, the surgeon on the *Blossom*, which visited Pitcairn in 1825.

Beechey's visit, by good fortune, was timed to permit observation of individuals of the F_1 hybrid generation. He was impressed by their height. Measurements which he made show a mean for the men of 177.8 cm. This compares with 170.6 for the 6 mutineers who left progeny, 171.4 for a typical group of Polynesians, and figures ranging from 169.1 to 172.5 for different groups of Englishmen. (Upper class Englishmen and "Old Americans" average taller than 172.5 cm.) Shapiro's measurements on the partially inbred descendants of a later generation show a mean stature of 174.0 cm., still above the parent stocks. Beechey did not measure the women. Shapiro found the mean height of females to be 161.7 cm. which compares

with 161.1 for Polynesians, and 161.8 for "Old Americans." Another visitor five years after Beechey independently commented on the height of the F_1.

Early observers also remarked on the physical strength and vigor of the islanders, and on their symmetry of form. Beechey recorded the lifting of weights of 600 lbs. in feats of strength.

Fertility is another gauge of vigor, and here again there are good data for the descendents of the *Bounty* mutineers. The number of children per family for successive generations is as follows (number of families in parenthesis): original cross, 4.17 (6); F_1, 7.44 (9); F_2, 9.10 (38); F_3, 5.39 (77); F_4, 2.96 (26 families, some of them incomplete). When husband and wife are from different generations, they are classified under the generation of the father.

Since heterosis is a maximum in F_1, the increase in family size in the F_2 generation from 7.44 to the remarkable figure of 9.10 children per married couple is unexpected. It is, however, apparently fully explained by age at marriage. Most of the first hybrid generation reached marriageable age while the colony was still under the patriarchial rule of John Adams, the last surviving mutineer. Adams was opposed to early marriage, with the result that the first hybrid generation females married, on the average, 5½ years later than did their daughters (average of 22.25 years at marriage as against 16.77). Five and one-half years additional of married life during the fertile early years presumably would have added about 2 children per marriage. The remarkable fertility of the hybrid population is indicated by the case of Maria Christian, a second generation female who married at 14 and had 25 children in 24 pregnancies (one pair of twins) by 3 successive husbands.

Shapiro believes that the use of contraceptives was a factor in the reduced family size in F_3. Marriage of relatives, which presumably first occurred in the F_2, also might have played a part by lowering the vigor of subsequent generations.

The information about size of families on Pitcairn and Norfolk Islands would tell more about the vitality of the Islanders if it could be compared with data from similar English and Tahitian groups. The average number of children born to Tahitian mothers in the original cross (4.17) is a control of sorts, but may be low. The fighting which occurred among the men during the first ten years might, for example, have tended to reduce it. As a clue to the fertility of women of English extraction in the absence of contraceptive measures, the size of families in Colonial America is of interest. Hoffman (1909), citing data gathered by himself and others from genealogies, gives 7 as the average number of children in the period 1700–1750, and 6.1 as the average in 1800.

First generation offspring from Hawaiian-North European crosses have been studied by Dunn and Tozzer (1928), and furnish an interesting comparison with the Pitcairn Islanders. Ten F_1 adult males averaged 173.5 cm. in height as compared with 171.3 cm. for 70 pure Hawaiians. For adult females the figure was 162.6 cm., for both groups (number of individuals measured, 10 and 34 respectively). The check with Shapiro's data is excellent, though the indication of heterosis is less than for the first generation hybrids in Pitcairn.

Boas (1894) made a study of half-blood Indians. He stated that the mixed race had approximately equal amounts of white and Indian blood. How many were F_1 hybrids is not indicated; the fact that the study was made in the last century probably increases the chance that some of them were. The white parents were mostly French. In the hybrid group, the mean number of children born to women more than 40 was 7.9. For full blood Indians living under comparable conditions the figure was 5.9. The half-blood children were shorter than the pure Indians, perhaps reflecting the short stature of their French ancestors, but they grew more rapidly and the adult hybrids were taller than either parent race.

Data from the census of 1910 provide a partial confirmation of Boas's figures. In this census, data were obtained on the number of children born to couples showing various degrees of Indian-white admixture. Three of the most pertinent data are as follows: Children born per married woman under 45 years of age, married 10 to 20 years (1) where husband and wife were full bloods, 4.5; (2) where both were mixed blood, 5.3; (3) where wife was full-blood, husband white, 5.4. The last figure appears to be out of line with data indicating an enhanced fertility for hybrids. In part it may reflect a greater fecundity of whites as compared with Indians. Other statistics from the same census point to such a relationship. It should be noted that many of the families included in this tabulation must have been incomplete. Presumably only a minority of the hybrids included were F_1's.

There have been other studies in which data have been gathered on growth and fertility of hybrids, but since all of them deal primarily with hybrids of the later generations we shall only mention them briefly.

Fischer (1913) studied a hybrid group in Southwest Africa which originated in the latter part of the 18th and first part of the 19th centuries. The parent stocks were Boer (mostly Dutch and German) and Hottentot. The hybrids numbered some 2500 or 3500 in 1913, but there had been much inbreeding. Fertility was high from the start. Fischer found that completed families averaged 7.7 children per couple. He has cited by way of comparison old Cape Colony (white) families with 6.3 children per couple, and statistics for African tribes comparable to the Hottentot of 6.3 and 5.7 children per female, but thought that enumeration may have been less complete than in his own study. The stature of the hybrids was close to that of Europeans and much exceeded that of Hottentots.

Rodenwaldt (1927) described a hybrid population that originated prior to 1819 by crossing of Europeans with natives of Kisar, an island of the Dutch East Indies. The fertility of this population, according to Rodenwaldt, must have been "very great" in the first generations. In the last two generations, 16 families averaged 7.3 young, including stillbirths.

Boas (1940) reported briefly on some observations which he made in Puerto Rico. In a study of the children of the island, it was found that the mulattoes excel in physical development the children of pure Spanish descent, and that their growth is more rapid.

While Davenport and Steggerda (1929, see also Davenport, 1928) stressed the disharmonies present in the mulattoes which they studied in Jamaica, their data seem to bring out just as clearly a precocity of mental development on the part of this group. These authors gave black, mulatto, and white children a battery of 22 mental tests. In the 13–16 year age range, the mulattoes excelled both blacks and whites in 12 of the 22 tests, were in second place on 9 tests, and in last place only once. The whites, who did next best, scored 8 firsts and 5 thirds. In the 10–13 year age range the advantage of the mulattoes was less pronounced, but still quite clear. The mulatto adults fell slightly behind the blacks and far behind the whites. (See section on disharmonies.) In rate of physical growth, the three groups were approximately equal.

THE "HALF-BREED"

There are numerous examples of hybrid populations produced by wide crosses which show a low record of achievement. These may account for the low esteem in which the "half-breed" is usually held. Gilbert (1946) has described ten mixed-blood racial islands of the eastern United States, mostly located in forbidding swamps or inaccessible and barren mountain country. The inhabitants are complex mixtures of White, Indian and Negro blood, and go locally under such names as Brass Ankles, Cajans, Croatans, Guineas, Issues, Melungeons, etc. The standard of living and the literacy rate tend to be low and the birth rate high.

Mjoen (1922, 1923) has described unfavorable results from crossing of Lapps and Norwegians in northern Norway. In four cases the half-breeds exceeded both progenitors in stature, and the Lapps with whom they were living in mental powers. Nine other half-breeds, however, were given to stealing, lying and drinking, which Mjoen regards as indicative of a want of mental balance.

Lundborg (1920, summarized in Gates, 1923) has noted unfavorable results from wide crosses in Sweden.

As is unfortunately the case with most mixed populations, we know too little about the ancestry of these hybrid groups to make a categorical statement as to why they have not been as successful as their neighbors. The answer, as Castle (1926) pointed out, perhaps may be found by inquiring "what sort of individuals contract mixed marriaged and under what conditions. Are they the best or the worst of their respective races?" Lundborg (*loc. cit.*) has found that such marriages are much more common among the poorer and lower classes, the middle classes maintaining a greater homogeneity.

Another possible factor, discussed further in the next section, is the occurrence of disharmonies. Aside from Mjoen's limited observations, data bearing on the possibility of hybrid vigor in these groups are lacking.

THE QUESTION OF DISHARMONIES

There has been considerable debate as to whether race crossing in man produces "disharmonious" combinations of characters. It will

be profitable to examine the evidence provided by animal experimentation, considering first F_1 hybrids, and then the hybrids of the later or segregating generations.

Up to a certain point, hybrid vigor increases with the width of a cross. Beyond this point, while hybrid vigor may still be manifest, unfavorable consequences supervene. Ordinarily this happens only in species crosses or crosses between genera. A well known example is the vigorous, but sterile, mule. Jennings (1930) cites the case of two unequal sized species of fish of the genus *Fundulus*, in the offspring of which the yolk sac is disproportionately large. Because this remains after swimming normally begins, locomotion is interfered with and death from starvation soon follows.

One of the very rare examples of an intraspecific cross with unfavorable consequences in F_1 hybrids is provided by Stockard's studies with dogs. Among Saint Bernards and several of the other large breeds, occasional animals appear which, though entirely healthy in most respects, show weakness and faulty gait in the hind legs. Some of these individuals exhibit definite and permanent paralysis of certain thigh muscles when only a few months old, even though they had been vigorous puppies before this age. Stockard (1936) made the surprising observation that the incidence of this type of defect was greatly increased by crossing the Saint Bernard and the great Dane. Among 57 three-months old puppies from this cross, all from healthy parents, all but 3 or 4 showed this paralysis to a greater or less degree. In the F_2 generation, approximately 22 out of 66 pups raised to 3 months developed the same defect.

Because of the increased variability of the segregating generations, it is reasonable to expect that in these generations occasional unfavorable recombinations will occur. Stockard (1941) has described crosses between different breeds of dogs which show this to be the case. Several types of disharmonies were noted. In some F_2 hybrids from the bassethound-English bulldog cross there was an exaggerated overgrowth of the skin. The skin area in certain cases was sufficient to cover twice the actual body size, and the skin formed deep folds over the head, body and legs.

In this cross also a variety of behavioral types was found among the F_2 hybrids. Some of these animals were classified as untrainable, and on autopsy showed an extreme internal hydrocephalus.

The most common type of disharmony in F_2 and backcross hybrids involved the jaws. Numerous cases were found in crosses between long muzzled and short muzzled breeds where the lower jaw was either too long or too short for the upper jaw. Both these conditions in their extreme form were accompanied by complete dental malocclusion. Dogs with the undershot condition were unable to eat food from a flat surface or shallow plate, and had to be fed from a deep pan. The first hybrid generation from these crosses showed only mild degrees of jaw disharmony.

The information in regard to the reported cases of disharmony in man is often insufficient to be sure of the generation in which they occurred. Most of them, however, perhaps all of them, have appeared in the segregating generations.

Davenport (1928), and Davenport and Steggerda (1929) have been particularly emphatic in regard to the occurrence of disharmonies. These authors studied the descendants of white-negro crosses in Jamaica. Their evidence for physical disharmonies rests principally on three mulatto women whose arm and leg lengths were out of proportion to each other by comparison with the normal range of either parent race. One of these "Browns" had unusually long arms and short legs the other two very short arms and legs of medium length. These observations find some confirmation in studies carried out by Rodenwaldt on the Island of Kisar in the Dutch East Indies. The population of this island includes a mixed stock descended from native women and white men of several European nationalities who were stationed there as soldiers in the 17th century. Measurements of this group revealed a correlation between arm and leg length such that an individual with the long legs of the European race also usually showed the long arms of this race. There were, however, exceptions,—individuals with one extremity of the European type and the other of the native type. The more distal portions of the arms and legs showed lower correlations than the arms and legs as a whole.

Abel (1933) has reported disharmonious combinations of teeth and jaws in Bushmen-Negro and Hottentot-Negro hybrids in South Africa. His study was based on a group of skulls collected by Pöch. Following in general Pöch's classification, he grouped the skulls as predominantly pure Bushman, pure Hottentot, pure Negro, Bushman-Negro mixture, or Hottentot-Negro mixture. The

Negro skulls show large jaws and correspondingly large teeth, while the Hottentot and Bushman skulls have smaller jaws and more delicate teeth. In these skulls the spacing and arrangement of the teeth is normal. Some of the hybrids, on the other hand, have inherited the large teeth of the Negro and the small jaw of the Hottentot or Bushman, with resulting crowding and misplacement of the teeth or, vice versa, the small teeth of the Hottentot and Bushman and the large jaw of the Negro, with resulting surplus of space. Abel found abnormalities in 6 of 20 skulls showing mixed Bushman-Negro characteristics and in 5 of 15 showing mixed Hottentot-Negro traits.

Whether these skulls represent F_1 hybrids or mixtures of a later generation is impossible to say, but since they come from a region where crossing may have been going on for generations, the latter alternative seems the more probable. Flemming (1929) has reported malformed jaws in European-African hybrids, but detailed evidence is not given.

Stern (1949) has pointed out that Rh incompatibility constitutes an important case of disharmony, but a very special one in that the incompatibility is between Rh-negative mothers and Rh-positive fetuses. This is only of significance in connection with race crossing on the assumption, made by some authors, that the present genetic constitution of the white race with respect to the Rh locus was derived from a cross of Rh-positive and Rh-negative strains.

It has been argued by several writers that not only physical disharmonies but also mental disharmonies occur. Davenport and Steggarda (1929) stated that "such disharmonies are apparently common in the adult Browns." Their evidence rests on the poor average showing of the Browns in a battery of psychological tests. As pointed out by Davenport (1928), "this insufficiency of the adult Browns depends upon the presence of an excessively large number of persons in the group who are incapable of making any progress at all with the task before them." Many of the Browns, on the other hand, made excellent scores. The question arises, are these mentally subnormal Browns the product of genetic disharmonies, or of a few defective genes derived from white ancestors who, perhaps because of these very defects, were driven to marry outside of their own race? Davenport's data do not permit an answer. The good showing made by Brown children (contrary to a curiously selected table presented by Davenport and Steggerda) has been pointed out in another section. Mjoen (1922, 1923) has also asserted the occurrence of mental disharmonies, but presented very inadequate evidence.

Some rather extreme views have been expressed on this question. One could easily get the impression from reading these that hybrid populations from the wider crosses must be universally backward and handicapped. Actually such hybrid populations, with occasional possible exceptions such as the mixed-blood racial islands already described, are consistently more successful than the pure non-white parent race (Park, 1921). This is true of American mulattoes. Thus according to Reuter (1931), mulattoes, in proportion to their number, produce 30 to 40 times as many men of exceptional ability as do pure negroes.

An interesting sidelight is provided by some observations made by Olmsted (1856) during his travels in the South. It was common at the time in New Orleans for well-to-do white men to keep mulatto mistresses, many of whom were themselves the offspring of similar unions, and most of whom had been brought up with advantages not accorded to other persons of their race. "The girls," wrote Olmsted, "are frequently sent to Paris to be educated, and are very accomplished. I have rarely, if ever, met more beautiful women, than one or two of them that I saw by chance in the street. They are much better formed, and have much more graceful and elegant carriage than Americans in general." Evidently Olmsted saw no disharmonies here!

In summary, disharmonies do occur in the F_1 from intraspecific crosses in animals other than man, but are very rare. In man, except for the special case of Rh incompatibility, there is no good evidence for their existence in the F_1. In the later generations, the segregation of genes apparently does result in the appearance of unusual and probably unfavorable combinations of physical traits. The frequency with which they occur is uncertain, but they are probably somewhat uncommon. Whether mental disharmonies occur is still an open question.

HETEROSIS IN THE NARROWER HUMAN CROSSES

Most of the great civilizations have arisen following crossing between branches of the white race. What is the evidence that such crossing produces hybrid vigor?

The white race (in discussing the branches of which I shall follow Coon's *The Races of Europe*) is an extremely variable group. In the light of recent discoveries, it is believed that many millennia ago crossings took place between *Homo sapiens* and the more primitive Neanderthal man, *Homo neanderthalensis*, and possibly also with other early species of man. The Neanderthal strain therefore did not become extinct, but passed over into the modern white race, or at least into certain of its branches, which are therefore biphyletic (or polyphyletic) in origin. According to Coon (1948, Fig. 30), the people of Europe are divisible into thirteen races of which seven carry traces of non-sapiens ancestry.

The original separation between the pure sapiens races, typified by the Nordics and the Mediterraneans on the one hand, and the races with Neanderthal admixture (Alpine, Borreby, etc.) on the other, occurred in the Riss-Würm interglacial (Coon, Fig. 30), or some 100,000 or more years ago (Flint, 1947). Figuring three generations to a century, this means a separation for 3000 generations. Since the number of our ancestors increases by a factor of 2 in each generation as we trace backward in time, an individual living today must, in the absence of inbreeding, have had 2^{3000} ancestors 100,000 years ago. Actually, this is an impossible number, since the total population of the world today is only about 2^{31}. Obviously, then, inbreeding must have occurred in these races subsequent to this separation, and in view of the smaller populations which prevailed under primitive conditions this inbreeding in the past, may have been quite close.

It is pertinent to inquire whether in the early days of each race it was close enough to fix a definite type, in the same sort of way, even if not to the same degree, that the characteristic types of the various domestic breeds have been fixed. The importance of this point lies in the fact that such fixation of type would also fix detrimental recessives, and thereby tend to enhance the effect of crossing. There are indications that some such fixation has occurred. Curious specializations have been produced. Thus the Lapps have a ridge along the middle line of the palate, and the Inca of Peru is specialized in the possession of an interparietal bone in the skull (Benedict, 1947). These are extreme cases. It must also be pointed out that some fixation of type can occur through selection alone without close inbreeding; the dark complexion of dwellers in warm climates may have been thus established. Also where types have been fixed in past ages there must have been much blurring of the edges by subsequent crossing. Such fixation as has occurred in the major divisions of the white race is much less definite than that found in the various breeds of domestic animals. On the other hand the human races have been separated for many more generations.

Races such as the Mediterranean and the Nordic are more recently separated than are the Alpine and the Nordic. Nevertheless the differences are still considerable. Even within the Mediterranean and Nordic races, metrically different though overlapping branches occur.

Some rather direct evidence that crosses between the major branches of the white race can produce favorable results is provided by studies of genius. Two German authors and one American (Reibmayer, 1908; Kretschmer, 1931; Dixon, 1923) have all come to the conclusion that genius is particularly apt to flourish in zones where two races are contiguous and apt to intermingle. "It is remarkable," wrote Kretschmer, "that we find three places within German speaking territory at which there is an incredibly disproportionate concentration of genius. . . . These three regions are: Saxony (with the parts of Thuringea and Silesia which border it), Swabia and the Netherlands. In every case these will be found to be spots where different racial zones pass immediately, and with exceptional abruptness, one into the other. Thus it is possible to consider this display of genius as a product of blood mixture."

Kretschmer has laid particular emphasis on the fruitfulness of the Nordic-Alpine cross. "If we pick out on the map of Europe the birthplaces of the greatest geniuses in art and science, and the regions where our most important cultural assets have arisen,. . . . and then superimpose this 'map of civilization' on a map of racial distribution, it becomes strikingly clear that the zones of Nordic-Alpine intermixture have been of quite disproportionately great importance in the more recent recent development of European culture."

Cattell, in his translator's preface to Kretschmer's book, stated that Kretschmer's "distribution of civilization" differs radically from that established by Huntington (*The Character of Races*, p. 230). I have examined Huntington's data with this critism in mind and am satisfied that there is not necessarily any conflict. Huntington estimated the number of eminent Euro-

peans per 10,000 population (as of 1800) *by countries*, and plotted this on a map of Europe, with lines drawn to separate zones of higher and lower eminence. Kretschmer was primarily concerned with *parts of countries*, and had he drawn a map this could have made his zonal boundaries quite different from those of Huntington. I must agree with Cattell, however, that it is unfortunate that Kretschmer did not present more of the data on which his conclusions are based.

Reibmayer (1908), in a book apparently almost unknown in this country, had anticipated Kretschmer in a number of his conclusions. Reibmeyer also gives a fascinating, though perhaps somewhat uncritical list, of famous persons of mixed parentage.

A fourth investigation indicating that zones fruitful in genius tend to be zones of race mixture is Ellis's *A Study of British Genius* (1926). Ellis distinguished seven foci of genius, three in England (East Anglia, a Southwestern focus including Cornwall, and the Welsh Border), one Welsh, one Scotch, and two Irish (Leinster and the adjoining portions of Munster, and Ulster). For all of these foci except that in Scotland, Ellis described in some detail the complex racial mixtures from which their people are derived. Thus of the first focus he writes: "East Anglia is a region very open to invasion; Brythons, Romans, Angles, and Normans all seem to have come here in large numbers; and it differs from every other English district (except to some extent Kent, a county closely allied to it) in continuing to welcome foreigners—Dutch, Flemish, Walloon, French—all through mediaeval times, down to the revocation of the Edict of Nantes at the end of the seventeenth century." Of course the population of all parts of Britain is mixed, and the crossing that has gone on in these foci would only be indicated as related to genius if it is greater than that which has gone on elsewhere in Britain. Ellis has indicated quite clearly that it was greater in the case of the East Anglian focus. As to most of the northern part of England not included in the three English foci, he has referred to it as "the predominantly Anglo-Danish part . . . containing the fairest population of the country." Evidently this is a relatively pure Nordic population. Ellis's description of the seven foci of genius would indicate that all of them, with the possible exception of Scottish focus, have been derived from more complex mixtures.

Since there is practically no Alpine element in Britain, the Nordic-Alpine cross which has been so important on the continent cannot have played any role here. [What other authors refer to as the Alpine strain in Britain, Coon presumably classifies as Brünn and Borreby.] In small areas in England, Scotland, and Wales there are brachycephalic Brünn or Borreby populations, which like the Alpine have Neanderthal ancestry, and in western Ireland the Brünn strain is a major element in the population. In general, however, the crossing which has occurred in Britain must have been between more closely related groups than the Alpine and the Nordic.

A cross which in this country has given rise to a number of distinguished individuals is the Dutch-English. Both nationalities in this case are predominantly Nordic so the cross is a close one. There are, however, differences. Without attempting to describe all of these we may point out two. First there is an important Mediterranean element in parts of England, but none in Holland. Second, whereas the Kelts are a dominant population group in England, the dominant position in Holland is held by the Franks. Since the period of Keltic expansion in Europe began about 500 B.C. (Coon, 1948) it may be presumed that the separation of the Kelts and the Franks dates back at least to this time. This represents a separation for some 75 generations.

It would be difficult to say whether these differences are sufficient to lead to appreciable hybrid vigor in crosses. It is interesting to note, however, that outstanding individuals have first appeared in certain old Dutch and English families in this country in the first or second generation following a cross. In the case of Theodore Roosevelt, who was one fourth Dutch with English, Scotch and French Huguenot admixture, the Dutch branch of the family had been in the United States for five generations before the crossing occurred. The family was definitely prosperous during this period, but produced no other individuals comparable to Theodore. William Penn, Henry Ford, and Senator Arthur Vandenburg are all Dutch-English F_1's, and in the case of Vandenburg both sides of the family had again been in this country for a number of generations prior to the cross.

Reibmayer (1908) found that a number of famous men have been derived from "class crosses." It would be difficult to determine whether the upper and lower classes of Europe are sufficiently separated genetically to produce heterosis in their hybrids. At least this appears to be a

possibility. Two well-known examples of this type of cross may be cited. William the Conqueror was the bastard son of Robert, Duke of Normandy by Arletta, the daughter of a tanner. Thomas Jefferson, on his mother's side, came from an old Virginia family, the Randolphs, which traced back to British aristocracy. His father, Peter Jefferson, though a man of energy and ability came from (by Virginia standards) ordinary "yeoman" stock. The first Jefferson to settle in this country was from Wales, but biographies do not make clear by how many generations he was separated from Thomas.

A psychological factor could well enter into the record of achievement of the progeny of class crosses. Persons so derived might feel under greater pressure to establish themselves than would anyone entirely secure in an inherited position. Possibly a breaking down of class lines accompanying extensive crossing is one of the reasons for the importance of the crossing.

In America and several European countries where records of stature have been kept over an adequate interval of years, it has been found that the height of the population has undergone a gradual but steady increase. The height of Harvard students during the past seven decades has increased 5.5 cm., or 1 cm. every 12.7 years. For Swedish recruits, the increase has been 4.3 cm. in seven decades, or 1 cm. every 16 years (Bowles, 1932). Broman, Dahlberg, and Lichtenstein (1942) have suggested that this increase in stature may be due in part to an increase in heterosis due to the breaking up of interbreeding populations or "isolates." That such breaking up has occurred is shown by the decrease in first cousin marriages that has taken place during the past half century (Dahlberg, 1942). Broman, Dahlberg, and Lichtenstein found the stature of 13-year-old boys to be greater in the city of Stockholm than in medium-sized Swedish towns, and greater in the town than in a rural district. It thus decreases with the size of the isolates. They believe that the environmental conditions are, if anything, better in the country than in the city and hence that the differences in stature are due to the differences in inbreeding. Lundborg (1931) has reached a similar conclusion.

Other writers have attributed the increase in stature during the past century to improved environmental conditions, particularly improved diet (Levine, 1939). Unseasonably hot summers have been shown to diminish the weight and probably the stature of girls in their teens (Mills, 1950). The data do not permit a final evaluation of the different factors, but it is an open question whether the degree of inbreeding which occurred in rural communities in the past was sufficient to reduce stature by 4 or 5 cm. There are no specific data on the degree of inbreeding of Harvard students of past generations, but most of them are probably from urban homes and certainly few if any come from the type of backward rural community where inbreeding is close. Bowles has estimated that 80 or 90 per cent have consistently been of "Old American" stock (defined as individuals with American born parents and grandparents). This does not rule out entirely, however, the possibility of increasing hybridization.

Further evidence on the possible effect of inbreeding in man has been provided by Asdell (1948) who finds that the most inbred members of the European royal families show a slightly lower average record of achievement than the group as a whole.

HETEROSIS AND GENIUS

This study was prompted by the observation, made over a period of years, that many famous persons are derived from a mixture of racial or ethnic stocks. From magazine and newspaper articles, encyclopedias, and biographies, a list of some one hundred such persons was obtained, of whom 75 are Americans (including Canadians and South Americans). Because material of this sort is unsuited for a statistical analysis of the incidence of persons of mixed origin among celebrities as compared with the incidence among the population in general, the full list is not given. However, the citation of a few of the more interesting cases will help to take the discussion out of the realm of the abstract. The cases cited have been carefully checked for accuracy.

I am indebted to the editors of TIME magazine for giving access to certain materials from its files, and to Miss Diane Kelton and Mrs. Betty Ann Peters, assistants at the Jackson Memorial Laboratory who were stationed at the Sloan-Kettering Institute in New York following the Bar Harbor fire, for assistance in the checking. Miss Kelton and Mrs. Ann Ingalls helped tabulate some material from Ellis's *A Study of British Genius* referred to below.

A number of famous athletes have come from the wider race crosses. For example, Jim Thorpe, who has been called the "world's greatest athlete," is one half Irish and one half Indian on his father's side, one fourth French and three fourths Indian on his mother's; and Bill Smith, who at 17 broke the world's records in the 200, 300 and 400 meter free style swimming and at one time or another has held 23 world's swimming records, is Irish on his father's side, English-Hawaiian on his mother's.

Many universally known Americans of the past or present come from mixtures within the white race. A few examples are William Penn (English-Dutch), Paul Revere (French-English), Alexander Hamilton (Scotch-French), Augustus Saint-Gaudens (French-Irish), Henry Ford (English-Dutch), Charles E. Wilson (Irish-English), Lily Pons (French-Italian), Leopold Stowkowski (Polish-Irish), Ely Culbertson (American-Russian), Raymond Loewy (Viennese-French). These are first generation hybrids. Among persons of more complex extraction are John D. Rockefeller, Sr., Theodore Roosevelt, Herbert Hoover, J. Edgar Hoover, Thomas Dewey, and Charles Lindbergh.

Accounts of famous persons of mixed origin frequently mention their precocity and phenomenal energy. Thus Sosthenes Behn (French-Danish), President of the International Telephone and Telegraph Corporation, was "an up-and-coming banker in Manhattan" at 19, and Harold Stassen (Norwegian-Czech-German), during his campaign for the 1948 Republican presidential nomination, was able to carry a "man-killing itinerary; in a single day, traveling by plane and bus, he covered 823 miles, made eight full-length speeches in seven cities."

Such cases are suggestive, but in the absence of a control group, inconclusive. It will be interesting to examine the literature on genius and see what light it can shed on the question.

Some evidence on the incidence of hybrids among persons of exceptional ability is provided by Ellis's *A Study of British Genius*. Ellis's work is based on 1030 eminent Britains whose birth dates range from the twelfth to the nineteenth centuries. Only 68 out of this total were born prior to 1501, 962 being born after this date. In an appendix, Ellis has given, wherever known, the place of birth of each grandparent, of the subjects of his study; otherwise, if known, that of the parents. If, using these data, we calculate the percentage of eminent men and women born in each century after 1501 who were hybrids, an interesting fact comes to light. For this purpose we define as hybrid all individuals involving a British-nonBritish cross, or a cross between any two (or more) of the four major divisions of Britain (i.e., England, Ireland, Scotland, and Wales). The cross may have occurred in the parental or grandparental generation. The data, tabulated by centuries, are given in Table 1.

It will be seen that there is a steady rise in the per cent of hybrids in each century, starting with 6.2 per cent in the sixteenth century and reaching 22.9 per cent in the nineteenth century, an increase of more than three fold. (Actually all but four of the nineteenth century individuals were born prior to 1850.) A breakdown of the figures shows that individuals of both mixed British and foreign derivation contribute to the rise. There are 95 individuals in the former group with a fourfold increase (in absolute numbers) over the four century interval, and 46 in the latter group with a tenfold increase. The departure from a proportional distribution by centuries is significant, with $\chi^2 = 23.7$ and $P < .01$.

TABLE 1

	1501–1600	1601–1700	1701–1800	1801–1900
Total no. individuals	161	191	372	223
Percentage for whom birthplace of more than one parent or grandparent is given	31.7	27.7	39.3	47.5
No. of hybrids	10	17	63	51
Percentage of hybrids	6.2	8.9	16.9	22.9

In Ellis's appendix B, the place-name is sometimes given in square brackets, indicating that the origins are either doubtful or are further back than the grandparents. Such cases are not included in the table. If they are added, the percentage of hybrids in the different centuries becomes 6.2, 9.4, 17.5, and 26.5.

A small part of the increase may be due to an underestimation of the proportion of hybrids in the early centuries. To get information on this point we have tabulated, by centuries, the percentage of individuals for whom the birthplace of more than one parent or grandparent is given. Hybrids for whom less information is available cannot, of course, be recognized as such. The

percentage rises from 31.7 in the sixteenth century to 47.5 in the nineteenth. This is only a 50 per cent increase as compared with a 350 per cent increase for the hybrids. It thus seems unlikely that the less complete information as we go back in time is more than a minor factor in the rise.

Further data on the percentage of hybrids among eminent Britons is provided by Galton's *English Men of Science* (1874). This study was based on information obtained from somewhat over 100 scientists in reply to a questionnaire. Since the men were contemporaries of Galton, most were probably born between 1800 and 1850 and hence belong to the same generation as Ellis's nineteenth century group. Galton obtained quite complete information about the forebears of this group, but unfortunately presented it only in summary form. It is sufficient to show, however, that between 30 and 40 per cent of eminent nineteenth century British scientists were of hybrid origin (using hybrid in the sense defined above), with about 10 per cent of these having foreign (non-British) ancestry. It seems likely that the higher percentage revealed by Galton's study as compared with Ellis's is due to more complete information.

A very important question is whether the per cent of hybrids among eminent Britons is higher than the per cent among Britons as a whole. On this point Galton has the following to say: "If we were to go to rural districts, or small stagnant towns, we should find much less variety of origin; but I think there would be quite as much in the more energetic classes of the metropolis, who have immigrated from all quarters. Some haphazard selecting which I tried confirmed this view . . . On an analysis of the scientific status of the men on my list, it appeared to me that their ability is higher in proportion to their numbers among those of pure race." On the other hand, in *Hereditary Genius* (1869, p. 360), Galton wrote, "It is very remarkable how large a proportion of eminent men of all countries bear foreign names, and are the children of political refugees." (Kolarz (1946) has pointed out that many famous Europeans have borne names foreign to the country in which they lived and worked. Some of them, at least, have been the offspring of marriages between foreign and native strains.) It would seem to me somewhat surprising if between one-fourth and one-third of all middle and upper class Englishmen born between 1801 and 1850 had a non-English parent or grandparent. Only one-fifth to one-tenth of all Harvard students have a non-American parent or grandparent (Bowles, 1932). If there are figures on a more satisfactory control group, I have not discovered them.

Whatever the incidence of hybrids among Englishmen in general may be, it seems clear from Ellis's data that there has been, over the past four centuries, a rise in the percentage of eminent men who are hybrids. We shall return to this point again later.

In gathering the biographical material previously referred to on celebrities of mixed origin, it early became apparent that an unusual number of actors and actresses were described in newspaper and magazine articles and various biographical notices as being of mixed origin. With no attempt at a complete search, 30 actors, actresses, dancers and producers, most of them very well known, were found who fall in this category, and it is certain that this list could be considerably extended.

This apparent high incidence of hybrids among actors and actresses is in part substantiated by data from other sources. Bowerman (1948), in *Studies in Genius*, has given data on the ancestry of 1000 famous Americans. The data are not as complete as might be desired, but, where known, the country of birth, or the country of origin, of the father's father and the mother's father are given. Using this information, a calculation of the number of certain and the number of probable hybrids is possible. Individuals are counted as certain hybrids where the father's father and mother's father came from different countries. Thirty-two out of the total of 1000 individuals, or 3.2 per cent, and four out of 13 actors and actresses, or 30.8 per cent, fall in this category. Probable hybrids include, for example, cases where one grandfather is foreign-born or of foreign extraction (but not English), and the other grandfather American-born. One hundred and fifty-one of all subjects in the study, or 15.1 per cent, and 7 of 13 actors and actresses, or 53.8 per cent, fall in this category. While some individuals are undoubtedly incorrectly counted as hybrids under this method of classification, it is unlikely because of the incompleteness of the data, and particularly the omission of any information about grandmothers, that the estimates are too high. The number of actors and actresses included in this study is too small to establish statistically a

high incidence of hybrids among them, but the results do tend in this direction.

Further data are provided by Ellis's *A Study of British Genius* (1926). Of the 1030 subjects of this study, 143, or 13.9 per cent are of mixed origin, while of 42 actors, 13 or 31 per cent are mixed. Ellis added, "Our knowledge of the ancestry of actors is peculiarly vague and uncertain," so the figure 13 may be low. On the other hand, allowance must be made for a particularly high incidence of hybrids not only in the actresses but also in all the notable women. Also, for an increase of hybrids in the last two centuries in which most of the actors and actresses were born. Small but essential omissions from Ellis's appendices prevent a more precise comparison.

Thus Bowerman's study, Ellis's study, and our own limited material all point to an unusually high incidence of hybrids among actors and actresses. No one of the studies taken alone proves this relationship, but the cumulative effect of all three is to provide rather strong affirmative evidence. I may add that I suspect there would be consternation in Hollywood if word were circulated that many of the actors and actresses have "heterosis!" Perhaps, however, when press agents describe rising stars as having "ping," "it," or "oomph" they are, to all intents and purposes, saying the same thing.

While the evidence is not all clear cut, its net effect is to give some ground for the view that there is a high incidence of hybrids among men and women with an exceptional record of achievement, with the concentration being perhaps higher in some fields of endeavor than in others. Various explanations have been offered for this relationship. Particularly plausible would seem to be one in terms of the heterosis produced by crossing. It would be most desirable, however, to have further evidence that crossing within the white race results in hybrid vigor. A promising approach would appear to be a study of the incidence of hybrids among outstanding college athletes as compared with college students in general. It is the hope of the writer that such a study may be undertaken by someone in a better position than he is to carry it out.

Various explanations other than heterosis have been offered for the relationship. Kretschmer suggested a psychological explanation of the effect of crossing in terms of a "germinal hostility. . . . in which two abruptly opposed inheritances. . . stand . . . in a constant mutual strain." This sounds like an echo of the disharmony hypothesis.

East and Jones (1919) and East (1927) have sought to explain the role of race mixture in terms of the increased variability of the second and later hybrid generations. The chances, they have contended, are greater in a heterogeneous hybrid population, such as exists in parts of England and Germany, for the occurrence of those rare combinations of genes that lead to genius than they are in more homogeneous stocks. "Genius, having no survival value, will always be rare, but it will occur more frequently in mixed races than in 'pure' races provided the components of the mixture furnish desirable supplementing genetic factors." These authors recognized the occurrence of "a notable amount of heterosis" in hybrids from the wider race crosses but made no mention of its possible occurrence within the white race. East and Jones advanced no specific evidence in support of this hypothesis, but I am inclined to believe that it is correct as applied to certain cases, perhaps particularly to cases within those professions where achievement rests primarily on mental endeavor. In professions where indefatigability is important, the evidence points to hybrid vigor as the most significant factor in the outstanding achievement of hybrids.

Many eminent individuals have had some handicap which they have had to overcome. Among the subjects of Ellis's study, gout was particularly common, and fourteen were known to have been subject to asthma. Theodore Roosevelt, who suffered from asthma as a child, is an example from among eminent Americans. It is of interest to note that since gout and allergy are both inherited as dominants, probably however with incomplete penetrance at least in the case of gout (Stecher and Hersh, 1945; Smyth, Cotterman, and Freyberg, 1948; Harkavy, 1949; Spain and Cooke, 1924), it is possible for F_1 hybrids to be subject to these complaints with the same frequency as other individuals, though in other respects they should have equal vigor with other hybrids.

REASONS FOR THE LAG BETWEEN THE BEGINNINGS OF RACE MIXTURE AND ITS FULL EFFECT UPON A CIVILIZATION

There has always been a lag of several centuries between the beginnings of race mixture in a new nation and the full flowering of its civilization (Petrie, 1911; Murphy, 1941; and others). Carr-

Saunders (1923) has argued that this lag makes untenable any explanation of the Elizabethan age in Britain, and even less of the Victorian age, in terms of a "germinal effect of race crossing." Actually an examination of the evidence shows that there are no fundamental difficulties in postulating hybrid vigor as one of the factors in the production of both those great periods in Britain's history.

It is fairly apparent that in a young nation most of the energy of the people has to be devoted to practical matters; it is only after a certain surplus of wealth has been accumulated that the arts and sciences can be extensively cultivated. This, I presume, would be generally agreed. The problem is not here, but in explaining why, some centuries after immigration has stopped, there continues to be a flow of new hybrids to maintain the initial high level of energy.

The answer may be in part that immigration does, in fact, not stop with the cessation of the initial waves of conquest. In the United States, immigrations did not reach its peak till 1907 (Steward, 1946), and we have already quoted Ellis (1926) in regard to the continued immigration into East Anglia. There is, however, another factor, namely, the maintenance over long periods of relatively pure stocks due to the tendency of people to in-marry. There have been a number of studies in this country which all agree in showing the existence of this tendency. We shall cite only one.

Savorgnan (1950) investigated racial intermarriage in Boston, using as the measure of intermarriage, the index of homogamy, H. The index is based on a formula such that when H equals zero there is complete independence or random meeting, when H equals 100 per cent there is complete in-marriage, or homogamy. He found that when H is calculated for marriages of native born with foreign born, its value is always greater than zero, indicating a consistent tendency to in-marry, but that it is much higher for certain foreign groups than for others. Some values are: Italians, H = 91.8 per cent; Swedes, H = 75.9 per cent; Irish, H = 64.7 per cent; English, H = 28.8 per cent; French, H = 25.4 per cent. Evidently a pure Italian population will persist in Boston for some time.

Russell (1946), in a fascinating paper on "the short dark folk of England" showed that a Mediterranean strain which arrived in Britain in prehistoric times has survived and maintained its identity for centuries. The earliest written indication of this group comes from the Domesday Book which recorded, as of the year 1086, the population of England by counties and by classes. Of the four classes listed one was the servi or slaves. In 1885, J. Beddoe published statistics on the height and nigrescence of Englishmen, again by counties. Russell showed that, for the various counties, there is a high correlation between both short stature and number of slaves and darkness and number of slaves. He therefore identifies the servi with a short, dark Mediterranean people, known to have been one of the early invaders of Britain. These Mediterraneans were conquered by the Kelts or some group preceding them, and assigned menial duties. With the arrival of the Anglo-Saxons they were resettled in small villages where the type was preserved as a result of in-marriage. In modern Britain it is still found among individual Welshmen, in the Midland factory districts and among the population of Glasgow (Coon, 1948).

Other distinct types survived in Britain for at least several centuries after the Norman conquest, providing strains from which, by crossing, hybrids could be derived. Coon (loc. cit.) wrote: "In our three series from the fourteenth and fifteenth centuries, then, we are struck by the tendency in England for local racial enclaves to persist and to be formed; the Rothwell series represents an Iron Age survival, that from Hythe a colonial carry-over from Roman times, and the Bristol collection a local Keltic and continental combination." If these enclaves began breaking up in the sixteenth century, the timing would be about right to produce the outburst of energy that characterized the Elizabethan age.

It is interesting to note several famous Americans of hybrid origin who came from strains that had been in this country for several generations without prior crossing. We have already pointed out that Theodore Roosevelt and Senator Arthur Vandenberg fall in this category. Another example is Herbert Hoover, whose German-Swiss ancestors on his paternal grandfather's side had been in this country two or more generations before a cross occurred.

As to Carr-Saunder's objection about the Victorian era, there were at this time, as we have already pointed out in discussing Ellis's data, a large group of eminent Britons derived from

crosses in which at least one parent or grandparent came from outside England.

HYBRIDS AND HISTORY

The striking record of achievement of hybrids is not confined to Europe and America. Dover (1937) has described the important role played in India by the Anglo-Indians who number some 200,000 souls. Jenks (1917) has told of the success in the Philippine Islands of Filipino-Chinese hybrids, particularly prior to and in the early days after American acquisition. A distinguished Filipino is quoted to the effect that "every prominent Filipino on the Islands possessed Chinese blood." Chinese intermarriage was favored by Filipino women.

On the other hand crossing has sometimes failed to produce favorable consequences. The mixed-blood racial islands in the eastern United States have already been described. Reibmayer (1908) distinguished two periods of admixture in Germany east of the Elbe River, with only the second producing numerous individuals of outstanding talent. The first period was characterized by Slavic-German mixture following an eastward migration of Germans. The second arose from a later eastward expansion with the immigrants coming from all parts of Germany and even from France and Austria. Nilson (1921) has told of the extensive mixture that took place in Rome during the declining days of the Empire.

The explanation of these unfavorable cases is probably to be found, in part at least, in the nature of the stocks involved. Lucan, the poet and friend of Nero, spoke of Rome in his day as being populated not by its own citizens but by the scum of the world, a revealing if possibly somewhat prejudiced statement. Where the cross is favorable, however, we may plausibly suppose that the resulting hybrid individuals, by bringing superior energy and stamina into many fields of endeavor can add significantly to the momentum of an advancing civilization. It is a permissible hypothesis that this is a reason, and perhaps the chief reason, why there has been a consistent correlation between race crossing and the rise of great civilizations.

SUMMARY

Historians have noted that the rise of great civilizations has been preceded by a mingling of two or more races. Most important has been the mixture of Alpine with Nordic or Mediterranean. In explanation (partial or complete) of this relationship it is suggested that such crosses produce individuals of exceptional vigor (hybrid vigor or heterosis) and that the accomplishments of these individuals give momentum to the developing civilization. The literature provides several lines of pertinent evidence.

Crossbreeding experiments with swine provide a precise, quantitative background. Hybrids show a consistent advantage over purebreds of 11 to 13 percent in litter size and rate of growth. Several studies of hybrid populations in man from the wider race crosses have revealed a comparable increase in fertility and probably an advantage in growth rate and/or adult stature as compared with related "pure" populations. It is pointed out that while heterosis is at a maximum in the F_1, it may persist in hybrid populations for generations at a reduced level.

Evidence is cited indicating that disharmonious physical combinations, such as large teeth in a small jaw, probably occur in the F_2 and later generations of the wider human crosses. However, they may be less important than some writers have believed.

The facts that the Alpine race is probably biphyletic in origin, having Neanderthal as well as sapien ancestry, and that the original separation from the other branches of the white race occurred some 100,000 years ago, are grounds for expecting considerable heterosis in crosses. The coincidence between regions of Nordic-Alpine crossing in Europe and regions of high incidence of genius is cited as evidence that hybrid vigor results from crosses within the white race.

In England, local "racial enclaves" persisted into the fifteenth century, providing genetically different strains for crossing. Since then, pedigrees of outstanding Britons show a steady increase in hybrids derived from non-English or English times non-English crosses. In the nineteenth century, 30–40 per cent of English scientists had a non-English parent or grandparent, but unfortunately there is no good control group with which to compare this percentage. Data from several sources indicate a remarkably high incidence of hybrids among actors and actresses. The tendency of racial strains to in-marry, thus preserving pure racial stocks, is cited as one reason for the lag between immigration and the full flowering of a new civilization.

It is pointed out that some crosses have not led to favorable results. This may have been because of the poor heredity of one or both of the parent strains.

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THE THEORY OF RATE PROCESSES AND GENE MUTATION

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INTRODUCTION

THE stability of genes, as reflected in their frequency of mutation under naturally or experimentally imposed contions, resides, as in any chemical system, in the frequency with which the genic structures transgress the limits of chemical stability to pass into new states of equilibrium and rearrangement. These considerations have been dealt with previously by Timoféeff-Ressovsky, Zimmer, and Delbrück (1935), and, in a popular fashion, by Schrödinger (1944). The former investigators, taking into account the temperature coefficient of the rates of spontaneous mutation and the frequency of induced mutations as a direct function of the total dose of ionizing radiations, have, as a first approximation, defined a mutation as a definite rearrangement in a definite molecule. They have, moreover, pointed out that the differences in rates of spontaneous mutation characteristic of specific genes can be logically understood by assuming only slight differences in the amount of energy of activation needed for a gene to exceed the limits of stability and thus pass over to an altered mode of expression, i.e., a small difference in the energy of activation would lead to enormous differences in the probability of occurrence of an event, in this case, a mutation. These same genes, however, would be expected to respond similarly to ionizing radiations, since each effective ionizing event imparts to the genic bond a far greater amount of energy than that necessary to exceed successfully the limits of stability. In a general way, these expectations have been experimentally confirmed. It would appear, therefore, that the hypothesis of Timoféeff-Rossovsky, Zimmer, and Delbrück, relating mutations, both spontaneous and induced, to the probability that the degree of freedom of the bond will exceed the limit of stable fluctuation, accounted in an entirely satisfactory manner for the data obtained for gene mutations. The events leading to mutation are considered to be chemical events consummated within the limits of time ascribed to chemical reactions, and dependent, insofar as ionizing radiations are concerned, in a linear fashion upon the amount of introduced energy.

The attempt to interpret mutation events and genic stabilities in terms of the known laws of physics and chemistry suffers, as the above investigators have pointed out, from the fact that the chemical molecule and the genic molecule had not been at the time, and are not yet, equated, plus the further complication that the criteria for change in chemistry and in genetics are, while similarly quantitative, at quite different levels of organization and integration. Recent studies in the area of induced mutations, however, suggest that, as in 1935, the time is again opportune to reconsider genic stability and change in terms of chemical kinetics. The discovery of chemical mutagenicity by Auerbach and Robson (1946), followed by the discovery of numerous mutagenic substances of quite unrelated structure, the phenomenon of delayed mutations in organisms such as bacteria and Drosophila, the potentiation and inhibition of x-ray, ultraviolet, and mustard effects by chemical and physical means, and the partial dependence of x-ray effects on oxygen tension and temperature, all suggest that the primary action of mutagens is in part, if not altogether, indirect, through the medium of activated radicals or complexes within the nucleus, rather than direct by the processes of ionization or photochemical absorption. A tentative approach to this problem has been made by Auerbach (1949) who, as the result of studies on mosaicism induced in Drosophila by mustard gas, has suggested that labile genic states can arise as the result of treatment, and that these, persisting for various intervals of time "in a shallow trough of energy, separated by low energy thresholds from two or more stable equilibria," can be pushed by subsequent slight additional supplies of energy in one or more directions toward a more stable state, either the original

state or a new one. In the latter case, a mutation would arise which could be detected if the phenotypic expression was sufficiently distinct to be recognized. This hypothesis is supported by temperature studies of zygotes obtained from mustard-treated sperm (Auerbach, 1949). Mosaicism was increased by exposure to low temperatures (16° C.) in contrast to high (29° C.), a fact which further suggests that the stabilization process has a pronounced temperature coefficient. The temperature effect is such as to suggest a stabilization of some intermediate which is essential for a later phenotypic expression of mosaicism (see below).

It becomes necessary as a consequence of these studies of Auerbach, as well as results of our own which can be similarly interpreted, to introduce into the mutation concept of Delbrück the idea of intermediate states of a metastable nature. Judging from Auerbach's work, these states, which may persist for some time, have a genetical expression which corresponds to that of the original gene (at least, this appears to be so in Drosophila); but they also possess an increased capacity for change into a new state characterized by a different mode of expression. The present paper will be concerned primarily with a consideration of this concept of gene mutation, together with the application to the process of mutation of the modern theory of rate processes, i.e., processes characterized by measurable rates, developed by Eyring and his coworkers. The hope is entertained that this reevaluation and review will serve as a guide to workers who are interested in bringing the concepts and tools of chemistry and physics to bear on the complex problems of genetics. The conclusions and suggestions which are to be presented are in part supported by unpublished experimental data, and will therefore also serve as an introduction to succeeding publications.

THEORY OF RATE PROCESSES

The theory of absolute reactions rates developed by Eyring and his associates (see Glasstone, Laidler, and Eyring, 1941) is based on the idea that a reaction is characterized by an initial configuration which changes continuously by various coordinates into the final configuration. During the configurational change there presumably occurs a critical intermediate configuration which is essential if the reaction is to continue to completion. This critical configuration is called the "activated complex" or the transition state of the reaction. This complex is considered to be located at the top of an energy barrier placed somewhere between the initial and the final states, and is to be regarded as an ordinary molecule with all the usual thermodynamic properties except that motion in one direction leads to the final state at a definite rate. Thus the rate of reaction is determined by the velocity at which the activated complex travels over the top of the barrier. The energy which must be attained by a molecule in order to reach the activated state is called the energy of activation ($\Delta H^{\ddagger}$), and is illustrated in Fig. 1.

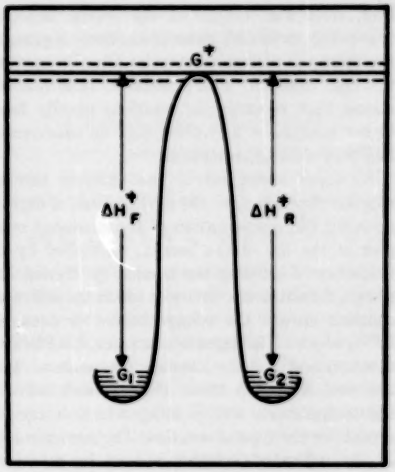

FIG. 1. VARIATION OF THE POTENTIAL ENERGY ACCOMPANYING THE REACTION: $G_1 \rightarrow G_2$.

The change in potential energy of the system is represented qualitatively by moving from left to right along the curve. The ordinate represents the potential energy and the abscissa the "reaction coordinate"; the latter is essentially the reaction path drawn in one plane. The turned-up ends of the curves indicate the vibration of the nuclei or the potential energy variation with interatomic separation. Before G_1 can become G_2 the former must acquire the energy represented by the maximum of the curve. The configuration, $G^{\ddagger}$, at the maximum is called the "activated state" or "activated complex" of the reaction. The difference in energy between the initial state, G_1, and the maximum, $G^{\ddagger}$, is the energy of activation, $\Delta H^{\ddagger}_{F}$. The same considerations hold for the reverse reaction: $G_2 \rightarrow G_1$.

The variation of the potential energy during the course of reaction is represented by moving from left to right along the curve shown. Before G_1 may react and pass into the final state, G_2, it must surmount the energy barrier ($\Delta H^{\ddagger}_{F}$), passing

into the activated state ($G^{\ddagger}$). The difference in energy between the initial state and the maximum of the curve is the energy of activation. The reaction illustrated in Fig. 1 shows that as the reaction proceeds to completion the energy of the complex is returned to the system, i.e., the activation energy has no necessary relationship to the heat of reaction (ΔH), which depends upon the equilibrium finally attained. It is evident, however, from Fig. 1 that in the reverse reaction ($G_2 \rightarrow G_1$), or in endothermic reactions in general, the energy of activation must at least be equal to the heat absorbed in the reaction. It is for this reason that endothermic reactions usually have higher energies of activation that do exothermic, i.e., heat-yielding, reactions.

An exact statement of the absolute rate of reaction depends upon the development of expressions for the concentration of the activated complex at the top of the barrier, multiplied by its frequency of crossing the barrier. As Eyring has shown, the effective velocity at which the activated complex crosses the energy barrier is equal to kT/h, where k is Boltzmann's constant, h is Planck's constant and T is the absolute temperature. This universal frequency factor thus depends only on the temperature, and is independent of the reactants or the type of reaction. The concentration of the activated complex cannot be measured directly, but it is assumed to be in equilibrium with the initial reactants ($G_1 \rightleftarrows G^{\ddagger}$) and can be described by the appropriate equilibrium constant ($K^{\ddagger}$). If r represents the specific reaction rate, the velocity of the reaction ($G_1 \rightleftarrows G_2$) is given by the following expression where $[G_1]$ equals concentration of reactants:

$$r = \frac{kT}{h} K^{\ddagger}[G_1] \qquad (1)$$

Since the constant $K^{\ddagger}$ is analogous to any other equilibrium constant, the following thermodynamic expressions may be substituted for it where $\Delta F^{\ddagger}$, $\Delta H^{\ddagger}$, and $\Delta S^{\ddagger}$ are respectively, the free energy, heat content, and entropy change that accompany the formation of the activated state:

$$\Delta F^{\ddagger} = -RT\ln K^{\ddagger} \text{ or } K^{\ddagger} = e^{\frac{-\Delta F}{RT}}$$

i.e., the free energy of activation depends upon the equilibrium between the reactants and the activated complex. Substituting in equation (1), we obtain

$$r = [G_1]\frac{kT}{h} e^{\frac{-\Delta F^{\ddagger}}{RT}} \qquad (2)$$

Since $\Delta F^{\ddagger} = \Delta H^{\ddagger} - T\Delta S^{\ddagger} = \Delta E^{\ddagger} + P\Delta V^{\ddagger} - T\Delta S^{\ddagger}$, the expanded equation for the reaction rate is as follows:

$$r = [G_1]\frac{kT}{h} e^{-\left(\frac{\Delta E^{\ddagger} + P\Delta V^{\ddagger} - T\Delta S^{\ddagger}}{RT}\right)} \qquad (3)$$

where $\Delta E^{\ddagger}$ and $\Delta H^{\ddagger}$ are the energies of activation when the reaction is carried out at constant volume or constant pressure, respectively, $\Delta V^{\ddagger}$ is the volume change of activation, and $\Delta S^{\ddagger}$ is the entropy change of activation.

Equation (3) shows that even under the simplest conditions the rate of reaction can be influenced by many factors. The energy required for the activated state is usually the chief factor determining the rate of reaction. The greater the energy of activation required, the fewer are the molecules that will acquire this energy, and consequently the slower is the reaction. Two different states with identical energy content may be separated by large barriers so that considerable time would be required before equilibrium between them could be reached. Thus the relative stability of a molecule at a given temperature and pressure depends upon the height of the energy barriers enclosing it. However, equation (2) indicates that it is not solely the energy of activation which determines the rate of reaction. The theory developed by Eyring demonstrates that it is actually the *free* energy of activation which is important for determining rate processes. In many reactions the entropy of activation is quite small, so that the energy of activation is approximately equal to the free energy of activation, and thus either of the latter two would give the rate approximately. Equation (3), however, shows that a large value for $T\Delta S^{\ddagger}$ can compensate for a high $\Delta H^{\ddagger}$ and thus lead to a higher rate of reaction than would be predicted from the latter alone. This concept has been successfully applied to such reactions as the denaturation of proteins and the inactivation of enzymes by Eyring, Johnson, and their associates (see Johnson, Eyring and Williams, 1942). The temperature coefficients of protein denaturation are often very large, giving energies of activation of over 100 kilocalories. In spite of this high value for the energy of activation, the denaturation

reaction usually proceeds quite rapidly even at normal temperatures. In many of these cases it can be shown that the high energy of activation, determined experimentally by plotting ln R against $\frac{1}{T}$, is counterbalanced by a correspondingly large increase of entropy accompanying the activation. The result is that $\Delta F^{\ddagger}$ is relatively small, which leads to the prediction that the reaction should be fairly rapid. Other examples to illustrate this point may be found in the articles by Johnson and his associates (see Johnson, 1947). Thus, under constant pressure, the rate of reaction can be influenced either by a change in the activation energy or by a change in the entropy of the system.

According to Eyring and Stearn (1939), the basis for the high entropies of activation which accompany protein denaturation may be ascribed to the breaking of salt bridges and the loosening of the usual restricted configuration associated with these complex structures. In this sense, the increase in entropy upon activation can be regarded as due to increased degrees of freedom or randomness of the reactant molecules.

Another factor which is important in influencing the rate of reaction is pressure. Equation (3) indicates that if the activation process proceeds with an increase in volume, then pressure should retard the rate of reaction; whereas if there is a decrease in volume, pressure should accelerate the reaction. For many bimolecular reactions it is to be expected that the activated complex will have a smaller volume than the sum of the volumes of each reactant. Measurements on a variety of such reactions have supported this prediction. The general concept has been successfully applied by Johnson and his coworkers to protein denaturation and enzyme reactions. Equation (3) provides the basic information from which the volume change during the reaction can be calculated from the data on the rates obtained at different pressures.

For the luminescent reaction in bacteria, Johnson, Brown, and Marsland (1942) found that at low temperatures pressure retards the rate, indicating that the reaction proceeds with an increase in volume. This volume change associated with the light-emitting reaction indicates extensive alterations in the structure of the molecule concerned. Johnson and Eyring (1948) have pointed out that these changes are probably associated with an unfolding of the protein from a globular to a more fibrous form. It is probable that such configurational changes are important in altering many different physiological processes. These ideas have been successfully applied to the general problem of inhibitor action (see McElroy, 1947; Johnson, 1947). The effect of pressure on the rate of morphological mutations in *Neurospora* indicates that a large increase in volume occurs during this process and thus suggests that profound structural alterations occur (McElroy and de la Haba, 1949). These results will be discussed in greater detail later.

Additional Factors Affecting Rate

It is usually assumed that once the activated complex is formed, it will decompose into the products of the reaction with a frequency of $\frac{kT}{h}$ (at 0° C = 5.56×10^{12}). However, if the activated complex is re-formed during the reaction, then the reaction rate will be modified. Consequently an additional factor, the transmission coefficient, k_1, is usually introduced to take into account this reconstitution. For most processes this factor is taken as unity, but in those cases where the slow reaction involves transfer of energy by colliding molecules the transmission coefficient may be quite small. Examples where the rates of reaction are affected by the transmission coefficient are discussed by Glasstone, Laidler, and Eyring (1941). Extremely small frequency factors have been reported for cis-trans isomerization reactions. It would appear from some of these examples that reactions with low energies of activation have low frequency factors, and that those with high activation energies have high frequency factors. It may be that such factors are of importance in considering the complex changes which undoubtedly occur during gene mutation. The recent results of Novick and Szilard (1949) indicate a very low frequency factor for mutation in *E. coli*. However, additional experiments at different temperatures and pressures would be necessary before any definite conclusions could be drawn concerning the reasons for this low value.

Another factor which may influence rate processes is the occurrence of "tunneling" or "leakage" through the energy barrier. This means that in some cases molecules may pass from the initial

state to the final state without acquiring the requisite activation energy. The leakage is generally small and can usually be neglected without serious error.

GENE MUTATION AND THE ACTIVATED STATE

A discussion of the process of gene mutation in terms of the theory of absolute reaction rates will assume that alleles differ from one another in molecular configuration, and that the change from an initial to a final configuration will take place through the formation of an activated complex, the hypothetical configuration in which the molecule passes over the peak of the energy barrier. The theory further assumes that in the formation of the activated complex a certain minimum free energy of activation is required to surmount the barrier, and that therefore the passage from one gene state to another is governed by the height of the barrier, other things being equal. These assumptions require no drastic revision of our usual ideas of genic structure, since it is unlikely that anything other than biochemical reorganization underlies the changes which take place within the cell to determine its reactivity and its phenotypic expression. In this sense, it makes little difference in the present discussion whether we consider each gene to be a molecular individual and unique in a mendelian sense, or whether we consider that particulate genes do not exist as such, i.e., that the gene does not have sharply defined limits in size. In either case, the assumption is made that molecular change forms the basis of phenotypic alteration. It is, of course, well known that heritable changes which give rise to more or less permanent phenotypic alterations form a heterogeneous group, some being associated with chromosomal rearrangements and others not, and it is uncertain at the present time how far our interpretation may be applied. But for heritable changes unassociated with chromosomal rearrangement (point mutations, or transmutations as defined by Stadler) the assumption is made that such transformations are basically chemical, and therefore conform to the laws of chemical kinetics. Granted this, the actual nature of the chemical transformation becomes unimportant in so far as the general theory is concerned, since it is clear that energy changes exceeding a specific magnitude are required for any particular reaction to occur. Since in no instance do we know the chemical structure of a gene, or the configuration changes which take place to alter its phenotypic expression, the interpretation can apply only in a general way. Certain assumptions can be made however, regarding gene states, mutation rates in general, and factors, primary and secondary, which should influence the rate of change of genic states under any given set of circumstances. In what follows, we shall discuss the gene in terms of allelic transformation only for the sake of convenience, and without any implication as to its particulate or nonparticulate nature.

Gene States

It is highly probable that a complex molecule of a protein nature can exist in a number of states which differ only slightly from each other in their geometrical relationships and stability. If this concept is transferred to the gene it seems unlikely that each state can be recognized as a new allele. Only when the metabolism or the morphology of a cell or an organism is sufficiently altered to provide a detectable change can these different states be recognized, and therefore the acuteness of the observer or the sensitivity of the detecting method becomes the limiting factor in determining both the number of states recognized and their frequency of change. Any geneticist who has been concerned with the determination of mutation frequencies is well aware of the magnitude of this problem, and its importance is heightened by the fact that there is good reason for believing that it is the more minute changes, and hence those most difficult to detect, which constitute the largest class of heritable alterations. This point may be illustrated by an example from sugar chemistry. Thirty-two isomers of a straight chain aldo-hexose, a relatively simple molecule, are possible. The empirical formulae of all these isomers are identical, but it is the geometrical differences that impart to each isomer its unique chemical and physical characteristics. By chemical means, such as substitution and degradation, the geometry of the various sugar types can be determined, but this is not yet possible with genic structures. At the present time, the various genetical procedures permit only the identification of differences of phenotypic expression; and it is only by deduction that differences in genic structure can be implied. The possibilities of such a diversity of isomeric structures are vastly multiplied as the complexity

of the molecule is increased, and this situation would be encountered in molecules of a protein nature such as we believe the genes to be.

On this basis, we assume that most if not all genes have many allelic states, most of them differing but slightly from each other, and indistinguishable except by the most refined biological techniques and criteria. The presence and action of modifying genes makes the problem of critical distinction between alleles enormously more difficult. Examples of multiple allelic systems showing a continuous gradation of expression are limited, however, to those where the various states are recognizable, and one must, by the very nature of the problem, draw on these for illustrative purposes. The self-sterility alleles, acting according to the hypothesis of oppositional alleles proposed by East and Mangelsdorf (1925), provide a clear-cut demonstration of the variety of detectable changes which a single locus can undergo. These have been widely found in the flowering plants, and a few specific examples will serve to illustrate the point. In *Oenothera organensis*, Emerson (1938) has shown that a relatively restricted population of 500 to 1000 individuals possessed at least 45 distinctly different and detectable alleles at the *S* locus. A similar situation holds for white clover, *Trifolium repens*. In two natural populations of different size, 49 plants of each were tested for allelic differences (Atwood, 1944). In the smaller population 36 of the 49 tested alleles were different, while in the larger 39 of the 49 were different. This means that 70 to 80 percent of the alleles were dissimilar in their phenotypic expression with respect to the compatibility reaction. Data of R. D. Williams (Bateman, 1949) reveal that the number of *S* alleles is actually much higher, over 200 being estimated to occur in a single variety of clover. The same situation holds in *Nicotiana*, *Tradescantia*, red clover, and a number of other species which have been tested adequately, and there is no apparent reason to believe that the condition is not generally applicable in so far as self-incompatibility is concerned. Lewis (1949) has provided evidence that the *S* locus in *O. organensis* consists of two inseparable but individually mutable parts, similar perhaps to the nature of the *R* locus in maize (Stadler, 1946). Such an arrangement, however, merely increases the possibilities of change at a given locus without affecting our concept of gene states or their mode of change.

The self-sterility alleles can be readily separated from one another on the basis of the testing procedures employed, much as, for example, the members of the allelic series at the white eye locus in *Drosophila* can be similarly distinguished. Not all alleles affects characters of so definitive a nature. The wild-type iso-alleles described by Stern and Schaffer (1943) at the cubitus interruptus locus in *Drosophila* provide an example of alleles which can be told apart only by the most exacting methods, and there is no reason for believing that this situation does not hold for every locus. The classic case is that of the two wild-type alleles of white eye which could only be distinguished by their mutation rates (Timoféeff-Ressovsky, 1934). Mention can also be made of the many alleles of erupt and of the suppressor of erupt which existed undetected in a wide variety of laboratory stocks and wild populations of *Drosophila* until Glass (1948) provided a means for their detection; and of the large number of alleles of *R* in maize (Stadler and Fogel, 1943, 1945). This situation has led Stadler (1948) to state that "among alleles of a given gene extracted from relatively unrelated populations, allelic diversity may be the rule rather than the exception. The appearance of uniformity (among alleles) may be due only to the insensitive criteria of phenotypic effect by which we recognize allelic differences." One can, of course, raise the question whether these particular loci are representative of the total population of loci which have been studied. At present the most plausible answer would have to be affirmative, since every locus intensively studied has been found to have more variability than was at first recognized. Many of these alleles, particularly if induced by radiations (e.g., those at the scute-achaete and brown loci in *Drosophila*) are associated with chromosomal rearrangements, but Stern and Schaffer (1943), like Stadler, expressed the opinion that isoalleles are very common.

To return to a consideration of our model of genic states, this concealed variation, if stemming from a molecular rearrangement within the gene as our hypothesis demands, can be included pictorially if Fig. 1 is visualized 3-dimensionally. Each stable gene state would be represented by a separate valley, linked to other allelic states on the same mountain by a series of inter-connecting ridges or barriers. Different pathways of reaction could also be included in such a figure so as to indi-

cate the number of possible ways by which one allele can be transformed into another, either directly or through a specific intermediate.

On a molecular level, therefore, the various allelic states differ from each other in the shape, composition, and geometry of their constituent parts. These alterations will determine the phenotypic properties of the locus much in the manner that the geometry of an aldo-hexose determines its chemical characteristics. In a complex genic structure, the number of possible reaction pathways from one state to another is large, giving rise to the possibility of many phenotypic manifestations for a particular locus. The various factors which may influence the particular pathways will be discussed later; however, it is well to point out here that a particular gene state may be reached by several different pathways, with intermediate steps in each pathway which can give rise to different phenotypic effects. It is possible, however, that a specific genetic constitution will lead to a restriction of reaction pathways, either by placing certain configurational restraints upon the gene or by lowering the energy barriers for certain pathways. Thus, in our 3-dimensional model, a lower energy barrier in the neighborhood of a particular genic state would trend to channel any subsequent mutations over that barrier and so lead to the frequent occurrence of a particular mutation. In this sense, the low energy barrier can be likened to a gap in a mountain range through which transportation would naturally funnel. Furthermore, the more complex the gene the greater is the possibility of an alteration in one portion of it without the remainder of the molecule being affected; this would provide for a genic structure of several inseparable but independently mutating segments making up a bi- or multi-partite locus such as that postulated by Lewis or by Stadler. The new allelic form of the gene, resulting from a change in geometry or constitution, will come to rest in a different valley, and it will be unstable or stable according to the heights of the adjacent energy barriers which it must traverse in order to pass back to its former state, or to some other allelic form.

Mutation Rates

If our assumptions are correct that the different genic states, whether those of all loci in general or those of the allelic series of a particular locus, are characterized by individually unique energy states, then it would not be unreasonable to suppose that the rate of passage from one gene state to another would be a direct function of the height of the energy barrier which must be traversed in order for a change to take place. If, for the sake of argument, we further suppose that the average height of a given barrier for a particular allelic series is lower than the average height of the barrier of another unrelated allelic series, then the former would be expected to have a higher over-all mutation frequency than the latter, other things being equal. The same supposition applies to the different allelic states of a given locus. It would be impossible, however, to make such a comparison directly, because even if standard environmental conditions and isogeneity of testing stocks were maintained, there would still exist a possibility that specific modifiers acting on particular loci might obscure the basic mutation rate which would, according to our concept, reflect the height of the energy barriers.

Even with this last qualification in mind, the genetic literature provides numerous examples which, so far as they go, fulfill the requirements of this hypothesis very well. The data of Stadler (1942) on the frequency of spontaneous mutation in maize are readily interpretable on the basis of different heights of energy barriers. The genes *R* and *I* were found to mutate at a rate of 492 and 106, respectively, per 10^6 gametes. The gene *Sh* mutated at a frequency of only 1.2 per 10^6 gametes, while *Wx* was not observed to mutate at all, although over 10^6 gametes were tested. On the basis of Stadler's (1946, 1948, 1949) later work on the *R* locus, however, it can be stated that these rates hold only for the particular alleles tested; the rates may be quite different for phenotypically similar alleles from other sources. A similar situation exists in *Drosophila* where the white, cut, yellow, and forked loci are known to mutate more frequently than other genes in the X-chromosome that likewise produce morphological effects.

For a comparison of the alleles of a particular series, the miniature (*mt*) locus in *D. virilis* is interesting. Demerec (1941) has shown that this locus has a number of alleles which are detectably different. The wild-type allele and three of the recessive forms are relatively stable; two other recessive forms, *mt*-3 and *mt*-5, are quite unstable, and each appears in three well-defined subforms which are recognizable on the basis of their differences in mutability. Subform *a* of both *mt*-3 and *mt*-5 mutates to wild type in the germ cells at a frequency

of about 4 per cent, and in somatic cells to give approximately 10 per cent of mosaic individuals, subform *b* is stable, mutating in neither germinal nor somatic cells; subform *c* mutates to wild-type only in somatic cells at a frequency of 4 per cent. In addition, each type can mutate to the other two, the rates being less frequent than those to wild-type but the same in proportionality. It has been assumed, in the case of each particular locus, that we are dealing with true allelism or transmutation, but this may or may not be correct in all instances. The data would suggest, however, that among the loci tested, there is a more or less continuous gradation of alleles in rate of mutability, a phenomenon to be expected if the process of change requires the acquisition of varying amounts of energy in order to carry the process through to completion. The extensive investigations of Timoféeff-Ressovsky (1934) on the mutability of the white eye locus in *D. melanogaster* is in excellent agreement with this concept. By studying the rates of different mutational steps he was able to show that some changes occurred quite frequently ($W \rightarrow w^a$) whereas others were quite low ($w \rightarrow w^a$). Of particular interest is the fact that in some cases a difference was observed in the "direct" and "reverse" mutations.

It must be recognized, on the other hand, that under normal environmental conditions other factors may contribute to the mutability of genes. Such factors, usually traceable to genetic phenomena which govern the rate of mutability, may affect the mutation rate of the entire complement of genes, or may affect only specific loci. The former instance is illustrated by the differences in frequency of recessive lethals observed to occur spontaneously in various laboratory stocks of *Drosophila* (Demerec, 1937; Plough, 1941), while the phenomenon of a specific influence upon mutability is provided by the action of the Dotted gene in maize which acts only to increase the mutation rate of a particular *a* allele to *A* (Rhoades, 1941). The action of the Dotted gene is itself modified by the action of another gene *M*, and both Demerec (1941) and Stadler (1949) have emphasized that a variety of modifiers can contribute to the frequency of mutation at a single locus. In order to fit these data into our concept of the process of gene mutation we must consider that the modifying genes assist in some way to move the initial gene state, G_1, over the energy barrier in the direction of a new state, G_2. This could conceivably be done by supplying, through chemical action, an additional amount of energy to the locus, thus activating it and enabling it to traverse more easily the energy barrier; or the action of the modifying gene could, in some undesignated way, appreciably lower the height of the energy barrier, so as to increase the probability of passage from one gene state to another. Such catalytic action could be general or specific, to give an increase in the overall frequency of mutations or a specific increase to certain loci. It is easier to imagine the former as taking place through a change in the general cellular environment, and the latter through the action of a specific mutagen produced by the modifying gene. It is not to be expected that this could be experimentally verified by treatment of genes with a specific chemical reagent because of the buffered environment provided by living cells, but as Stadler (1949) has pointed out, "chemical alterations effected by gene action escape this limitation." Auerbach (1949) has raised the question whether there may not be specific natural mutagens, some possibly gene-initiated, to account for the action of such modifiers as Dotted but the difficulties in the way of experimental verification of this hypothesis are insurmountable at the present time.

If the mutability of genes were simply a function of the height of the energy barrier, we would expect unstable genes to have a lower temperature coefficient than their more stable neighbors, as was suggested by Timoféeff-Ressovsky, Zimmer, and Delbrück (1935). Such is not the case, however, a fact which indicates that monomolecular kinetics do not apply here. The concept of the activated complex, on the other hand, enables us to bridge this difficulty. If the rate of formation of the complex depends upon the buffering capacity of the cell, the cellular environment, and the amount and specificity of a cellular mutagen (intrinsic or extrinsic), then one can conceive of the process of mutation as the end-result in a competing system, one part of which tends to stabilize the genes, the other to hasten their rate of change. A situation analogous to this has been described for the action of various inhibitors on enzyme catalyzed reactions at different temperatures. With a rise in temperature, the rate of an enzyme-catalyzed reaction increases exponentially. In the presence of an inhibitor such as urethane the rate likewise increases with an increase in temperature, but in comparison to the normal controls the increase is not as great; in other words the percentage of inhibition in-

creases with temperature. The application of the concepts of rate theory to this process indicates that there exists under these circumstances a competition between two rate processes, one of them leading to enzymatic catalysis of the reaction and the other leading to a reversible inhibition of the enzyme. The equilibrium constants of the competing processes determine the temperature at which there will be a maximum rate of the enzyme-catalyzed reaction.

FACTORS AFFECTING THE FREQUENCY OF MUTATIONS

In calculating the rate of change in a chemical reaction it is axiomatic that temperature, pressure, and concentration of the reactants must be standardized. In addition, the presence or absence of any catalyzing agent must similarly be known. Any attempt, therefore, to view the genic complement as a chemical system obeying the laws of chemical kinetics must of necessity bear these factors in mind. The transference of these concepts to a consideration of the process of gene mutation presents no particular difficulty, and the topic has been discussed in terms of chemical kinetics before by many authors (see Timoféeff Ressovsky, Zimmer, and Delbrück, 1935). Here we are concerned only with the process of gene mutation as it may relate to the theory of absolute reaction rates.

If one gene state is separated from another by an energy barrier (as described in the previous section), then there are two immediately obvious ways by which the mutation process might be accelerated: first, by supplying the necessary activation energy to the particular gene locus; second, by lowering the activation energy or barrier. Whichever be the case, the net effects are identical, although certain steps may have been altered. According to the simple chemical kinetics previously discussed, the total number of genic alterations which occur will depend upon the temperature, pressure, and the number of loci containing sufficient activation energy to surmount the barrier. Since all of these factors are important for each individual step and for each locus, it is theoretically possible for different mutagenic agents to act preferentially on certain intermediates. Thus a certain mutagenic agent might accelerate the mutation rate of a particular locus either by increasing the concentration of one of the intermediates or by preventing the return of the intermediate to the normal state. A great deal of this effect could be brought about indirectly, by influencing normally operating metabolic processes which tend to stabilize the gene structure. By the use of specific environmental factors, such as temperature and pressure, it should be possible to determine some of the properties of the intermediates and how they may be influenced by supplementary agents. The intermediate steps in passing from one gene state to another may in themselves be separated by large energy barriers, and yet may give rise to identical physiological effects, i.e., by our present tests of gene mutations it may only be possible to detect the final product. Or a small physiological change associated with one of these intermediates might eventually emerge phenotypically through associated changes in the environment. It is conceivable, therefore, that an allelic series represents such intermediate but stable stages in the alteration of a particular locus.

In a study of gene mutations all workers have, by necessity, used physiological or morphological characteristics of the final states as criteria of some change occurring in the gene, since it has not been possible to study specific intermediates. This information is useful, however, in that it allows us to estimate the energy difference between the initial and final states of a particular gene locus. It would appear from such studies as have been concerned with the stability of mutant genes, particularly those in an allelic series, that the energy states of multiple alleles do not differ greatly. Since it is well known that additional high-energy quanta applied to the system (x-ray, ultraviolet, etc.) will accelerate the interconversion (mutation) of these states, but that quanta of lower energy (visible light, infra-red) will not, we must assume that the latter are separated from one another by fairly large energy barriers. In other words, although there is very little energy change in passing from gene state G_1 to gene state G_2, the rate of attaining equilibrium is a relatively slow process due to the energy barrier. The fact that this amount of energy is required irrespective of the direction of mutation supports the idea that the free energy change in passing from G_1 to G_2, or vice versa, is very small. This is not to say, of course, that all loci have the same energy levels. The work of Timoféeff-Ressovsky (1933) on eye color alleles at the white locus in *Drosophila* has indicated clearly that there is a difference in energy level for these different gene states.

The energy relationship between hypothetical

gene states 1 and 2 is illustrated in Fig. 2. The figure is drawn to show that G_1 and G_2 have slightly different energy levels but are themselves separated by a large energy barrier. For G_1 to pass over to G_2 it is necessary for the molecules to acquire energy from the environment at least equivalent to $\Delta H^{\ddagger}_{F}$, the energy of activation. For G_2 to return to G_1 it is necessary for the former to acquire an energy of activation equivalent to $\Delta H^{\ddagger}_{R}$.

Under normal environmental conditions it appears from the apparently low mutation rate generally observed that a gene state rarely acquires sufficient activation energy to pass over to a new, mutated state. Several questions may be raised, however, concerning this apparently low rate. It is evident from equation (3) that the rate of reaction depends upon the concentration of the reactants. In studies concerned with comparative mutation rates this factor is unimportant, since it remains the same for all experiments. However, for determining the absolute rate it is necessary that the concentration of G_1 be known. In the study of gene mutations one is usually concerned with very large populations, yet the actual mutation event for a particular locus must of necessity occur within a single cell. This obviously limits the total number of reactant molecules to the total number of alleles present. If one considers each locus as an individual molecular species it is evident that the molar concentration is accordingly quite low.

Considering for the moment only the energy of activation $\left(\frac{\Delta E^{\ddagger}}{KT}\right)$, it is evident that if $\Delta E^{\ddagger}$ is large, the rate of mutation due to thermal effects should be quite small. In other words, the greater the ratio of $\Delta E^{\ddagger}/KT$, the smaller are the chances that a particular molecule will acquire the necessary energy of activation from thermal effects; that is, the stability of a given state is greater the higher the ratio. It is clear, at least for some loci, that the ratio $\Delta E^{\ddagger}/KT$ is small, i.e., that the energy of activation is actually low.

Temperature has long been known to alter the mutation frequency of organisms, a subject which has been reviewed by Plough (1941). In general, it can be said that increasing temperatures lead to an increase in the frequency of mutations, with the reaction having a Q_{10} value of 2 to 3. Timoféeff-Ressovsky (1934) has shown, however, that if the time of development of the organism (*Drosophila* in this instance) is taken into consideration, the corrected Q_{10} rises to about 5. This is a higher value than one would expect on the basis of a simple chemical reaction set into motion by thermal energy or by the energizing action of an enzymatic catalyst of cellular origin. It appears, more likely, that the mutation process is one involving many intermediate and reversible steps, and that

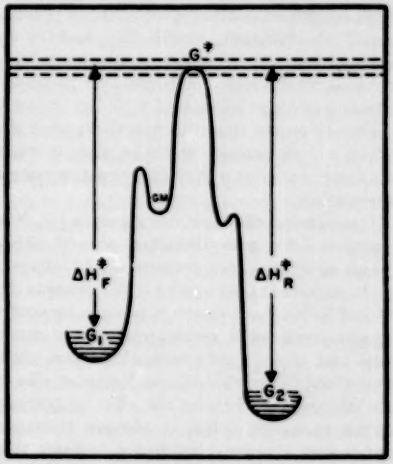

FIG. 2. VARIATION OF POTENTIAL ENERGY ACCOMPANYING THE REACTION $G_1 \rightarrow G_2$.

Same explanation as in Fig. 1 is applicable except that a small intermediate valley or shallow basin is shown as a possible intermediate step. This simplified diagram indicates two possible successive steps in the activation process: $G_1 \rightarrow GM \rightarrow G^{\ddagger}$. Although each individual step will have its own particular potential energy surface, the energy of activation for the overall reaction is determined by the highest peak, $\Delta H^{\ddagger}_{F}$. It is possible for G_1 to pass over the highest barrier without necessarily passing through the intermediate state, GM. In some cases, however, G_1 may acquire sufficient energy only to pass into the state GM. In this position there may be other pathways of reaction not indicated on the diagram which are available and GM may therefore decompose into $G_{1,2,3,4}$, etc. See text for a discussion of these ideas in relation to gene stability. The diagram also indicates that the reverse reaction $G_2 \rightarrow G_1$ requires a greater activation energy, an amount which is equivalent to the energy difference of states G_1 and G_2.

the influence of temperature will vary depending upon the manner of induction of mutations, and the particular steps required to carry the process through to completion. This interpretation is suggested by the fact that the action of the Dotted gene on the *a* locus in maize is enhanced by a drop in temperature (Rhoades, 1941), a condition also found in *Portulaca* when the mutation rate of a

particular unstable gene was estimated (Fabergé and Beale, 1941). In view of these findings, it is more plausible to look upon the cell as a system in which mutagen substances are found at all times, but that normally the genes are sufficiently buffered against their action by other chemical systems which compete for the mutagens. Inhibition of the competing systems or an increased production of the mutagens would alike lead to an increased frequency of mutation, whether considered in terms of a mutagen specific for a particular locus or a mutagen which acts on all loci. It is not possible to predict from this hypothesis what the influence of temperature would be, since it might affect one or another part of the competing system preferentially.

Reconsidering the basic rate equation (3), it is clear that if the genic alterations proceed with a change of volume, then pressure should influence the mutation rate. By applying the concepts developed by Eyring it should be possible, by studying gene mutation at various pressures, to obtain some idea of the configurational changes which come about during this process. Recent studies in this laboratory concerning the effect of pressure on the mutagenic action of nitrogen mustards, x-rays, and ultraviolet irradiation indicate that profound structural alterations occur during the passage from one gene state to another. Before discussing these results in relation to the gene model developed above, however, it is necessary to consider the general problem of the mutagenic action of various types of irradiation in the light of recent developments.

It is somewhat difficult at this state to view in a proper light the action of radiations of various sorts on mutation rates. Radiation of a mutagenic sort can be looked upon as a means of introducing a large amount of energy into molecular systems, and it is certain that gene mutations are markedly increased in frequency in this manner. Difficulty is encountered, however, when a critical examination is made of the mendelizing changes which are produced, and no general criteria are available which permit a clear-cut distinction to be made between true gene mutations (transmutations) and those chromosomal aberrations which simulate mutations. Ultraviolet radiation is somewhat less likely to induce chromosomal changes than are x-rays, while at the same time it induces apparently true mutations in appreciable numbers (Stadler and Roman, 1943, 1948). Yet the entire picture remains to be clarified. As to the radiation itself, it would seem that it either provides the molecules with the energy which permits them to surmount adjacent barriers and to pass to altered states, in which case a gene mutation is produced, or otherwise that it effectively breaks bonds to such an extent that chromosome breaks are induced. The initial step would be ionization, as in the case of x-rays, or photochemical absorption, as in the case of ultraviolet radiation. The situation is apparently not quite as simple as it would appear, since the relationship of oxygen to the effectiveness of x-rays strongly suggests that the action of x-rays and ultraviolet radiation on genes and chromosomes is indirect rather than direct, at least in part, and that chemical mutagens, possibly organic peroxides of some sort, are the immediately effective agents of mutation. There are, in fact, experimental data which suggest that both mechanisms operate to induce mutations. It has been shown that organic peroxides are effective in inducing mutations with a low frequency (Dickey, Cleland, and Lotz, 1949) while Stone, Wyss, and associates (see Stone, Wyss, and Haas, 1947) have demonstrated that irradiation of culture media with ultraviolet rays can similarly raise the mutation frequency of bacterial cultures which have not themselves been exposed. It is quite likely that the mustards act in a similar manner, by combining with genic structures to form complexes, some of which eventually pass over the barrier into new recognizable states. This is supported by studies which have shown that pretreatment of spores of *Aspergillus* with a non-mutagenic mustard concentration greatly enhances the subsequent effect of a given dose of ultraviolet rays (Swanson and Goodgal, 1947). Since the ultraviolet-induced mutation frequency follows closely the nucleic acid absorption curve, it is likely that the ultraviolet energy is trapped directly by molecules which have already been raised to a more unstable state by the mustard, leading therefore to a greater frequency of mutations. Also, further studies on *Aspergillus* have demonstrated that a combination of exposures of spores to both x-rays and ultraviolet radiation leads to a frequency of mutations significantly greater than that expected on a simple hypothesis of a summation of effects (Swanson, in press). These data seem best interpreted by assuming that in addition to the mutants which are induced at the time of radiation there remains a pool of potential mutants which can be pushed over into a recognizable state by the

addition of other radiation. The fact that it makes no difference which radiation is used first suggests that both x-rays and ultraviolet rays can leave the gene in an unstable, intermediate state for a period of time following exposure, and that non-mutagenic agents can influence mutation when applied subsequent to exposure to a mutagen. This investigation has been pursued in these laboratories, and results have been obtained which are not inconsistent with this hypothesis.

Two other pieces of experimental evidence support the idea that such metastable genic or chromosomal states can exist. The first is that of Auerbach (1949) on the mosaicism induced in *Drosophila* by mustard gas. Low temperatures were found to increase the frequency of mosaics and she has interpreted this by assuming that the gene can exist in a "shallow trough of energy" intermediate between a normal and a mutated state. Low temperatures (16° C) then tend to stabilize this state and hence to delay expression of the mutant for a number of cell generations whereas high temperatures (29° C) act on the metastable state to return it to a ground state, or push it over to a new, mutated state before the occurrence of cell division, thus reducing mosaicism. It is of interest to note that the metastable state has a wild-type phenotypic expression, at least so far as Auerbach's data indicate. The second piece of evidence is that supplied by the effect of infrared radiation on X-radiated chromosomes. Infrared radiation increases the frequency of x-ray-induced aberrations when given either as a pretreatment or as a posttreatment (Kaufmann, Holaender, and Gay, 1946; Swanson and Hollaender 1946; Swanson, 1949), but the effect of infrared can be completely eliminated by a subsequent temperature shock (48° C for 30 seconds) (Swanson and Yost, 1951). Also, the effectiveness of infrared radiation is a function of the temperature of the cells at the time the infrared is applied, low temperatures increasing its effectiveness. The similarity of these relationships to that known to exist in phosphorescent materials in which energy may be trapped is obvious.

The effect of pressure on the mutagenic action of x-rays and ultraviolet light clearly establishes the fact that the action of these agents requires time before a heritable alteration is stabilized. Thus both in the case of x-rays and ultraviolet radiation the application of high hydrostatic pressure after irradiation greatly lowers the mutagenic effect (McElroy, unpublished). The action of pressure is effective even when applied as much as 20 minutes after the irradiation has ceased. As has been shown for nitrogen mustard (McElroy and de la Haba, 1949), extensive molecular rearrangements apparently occur during the genic or chromosomal alterations which are induced by irradiation. Since pressure influences the mutation rate up to 20 minutes after treatment with the mutagenic agents, it seems clear that the chemical alterations which lead to gene change are freely reversible for a definite interval. The results imply that a transitory semi-activated complex is formed, which finally decomposes either to the previously "normal" state or to a mutant state. The decomposition to a mutant state apparently proceeds with an increase in volume, since pressure prevents its occurrence. It is therefore clear that the transition from the normal to the mutant state is not coincident with the adsorption of the light quanta.

Whether the delayed effect of x-rays and ultraviolet radiation is due to the action of some photochemical product which is produced in the cytoplasm, or whether it is due to a slow stabilization of structural alterations in the chromosome at the time of the irradiation cannot be determined conclusively by supplementary treatment. Although recent evidence indicates the possibility that cytoplasmic mutagens may be produced by irradiation, the present results could be interpreted equally well on the basis of a slow stabilization of some semi-activated state of the gene.

An important point in the development of the present concept of gene states and gene mutations is the fact that temperature has been shown to have a profound influence on the delayed action of mutagenic agents in general. We have found this to be true both in *Aspergillus* (Swanson, unpub.) and *Neurospora* (McElroy, unpub.), observations which agree with those of Auerbach (1949) on mosaicism. It should be emphasized that previous results indicated that pressure had an opposite effect to that just described when, instead of morphological mutants, chemical mutants were studied. The effect of pressure on the process yielding biochemical mutations indicated that these mutations were accompanied by a volume decrease such as might be expected to occur in a simple bimolecular reaction. The differential effect of pressure on the induction of morphological and biochemical mutants supports previous evidence that these two types of mutants are different in

nature (Swanson, McElroy, and Miller, 1949). The results suggest that extensive molecular rearrangements may not necessarily occur at the time of the initiation of genetic change. A more extensive analysis of a variety of genic loci under various conditions of pressure and temperature is necessary in order to approach an understanding of the physical-chemical alterations which may be involved in the production of mutations. It is well to keep in mind also that the measured rate of mutation may be composed of many individual specific rate constants which would complicate considerably an analysis of the over-all process.

CONCLUDING REMARKS

In considering the mechanism of gene mutation, the experimental evidence which is at present available indicates that the formation of at least one semistable intermediate is possible in passing from one allelic state to another. The potentiating effect of infrared radiation on changes induced by x-rays can be so interpreted, and as previously was pointed out, the mutagenic effect of nitrogen mustard can be partially reversed by high pressure if the latter is applied within twenty minutes after the mustard has been removed from the environment. Thus, in addition to the initiation of a molecular change which may or may not be expressed as a mutation, it is necessary to consider that a time component is essential to the process of stabilization of the intermediate and of the completion of the process of mutation. In radiation experiments, this means that the induction of a mutation does not necessarily coincide with the absorption of energy; in mustard experiments, it means that the complexing of the genic material with the mustard has a definite lag before the process is consummated. The posttreatment effects of both pressure and temperature indicate the existence of the latent period and at the same time they clearly indicate that the stabilization time of the intermediate is sensitive to temperature. Certain nitrogen mustard experiments may be cited in support of this hypothesis.

If, after exposure to nitrogen mustard, microconidia of *Neurospora* are quickly washed, the spore suspension can then be divided into two fractions, one to be held at 10° C and the other at 25° C. High hydrostatic pressure applied after 30 minutes had elapsed had no influence on the number of mutants which were obtained from the sample held at 25° C, whereas the same pressure reduced the number of mutants in the 10° C sample by 20 to 40 per cent. On the basis of the theory of rates which has been discussed, these experiments further indicate that the molecular processes which give rise to mutations are accompanied by significant volume changes in passing from the intermediate to the mutant level. Other experimental evidence suggests that similar relationships of time, pressure, and temperature also apply to mutation processes induced by ultraviolet and x-rays.

Initiation of the genic change may therefore be pictured to occur in the following manner. A chemical mutagen—naturally occurring, radiation-induced, or artificially applied—in combination with a particular group in the genic structure initiates a series of reactions which gives rise to an intermediate semi-activated state. This state "*GM*," illustrated in Fig. 2, may lead to a permanent change in the genic structure, or it may after a period of time, revert to the normal state. Environmental circumstances will affect the probability of its going one way or the other. The potential energy barriers which it must surmount in order to pass into a new state of equilibrium are also pictured in Fig. 2. Wherever the state "*GM*" may rest, in an energy depression or valley along the reaction pathway, the position which it occupies and the depth of the depression in which it resides will determine the effect that subsequent environmental agents will have on its stability and direction of change. In the case of mustard and infrared radiation, one must assume that the intermediate rests in a "shallow trough," escape from which requires little activation energy, since temperature has a marked effect on the outcome. Such intermediates are of course the sort one would most likely encounter because of the striking temperature effect; whether there exist more stable intermediates has not been determined.

It is not to be supposed that all gene mutations must occur in this manner. In radiation experiments, in particular, it is more than likely that many mutations are induced by the initial acquisition by the genic structure of sufficient energy to surmount the barrier in one step and immediately decompose into a new, mutated state. A volume change would accompany such reactions, and high pressures would have to be applied during the radiation to reduce the rate of such reactions. To our knowledge, this has not yet been done. However, a measure of the number of gene states which have

sufficient energy to pass directly over the barrier from state G_1 to state G_2 can be obtained from pressure experiments. Certain mustard-pressure experiments carried out by the senior author indicate that an average of 40 per cent of the total possible mutants have occurred during the mutagen treatment, and that the remaining loci which are to change require a certain amount of time for the completion of the process. It is these which are subject to environmental control.

It is to be expected that each locus will have its own particular energy characteristics, intermediates, and pathways of reaction. A determination of these is a necessary, although monumental, task if we are to understand the mechanism of gene mutation in its entirety. A study of the reverse mutation rates of specific genes in microorganisms seems to offer the most promising avenue of approach, for by this method large numbers of individuals can be studied, and the techniques of genetics, chemistry, and physics can be brought to bear in precisely controlled experiments.

The present attempt to apply the concepts of Eyring's theory of absolute reaction rates to such a complex and experimentally elusive process as gene mutation may, to some workers, appear premature. The experimental data available would suggest otherwise, however, and what has clearly impressed us is the fact that all of the known facts of gene stability and variability can be accounted for within the limits of the theory. We may delude ourselves in this respect because of the all-embracing nature of the concept, but the successful application of it to enzyme and protein studies and the obviously enzymatic and proteinaceous nature of the gene, warrant a serious consideration of Eyring's ideas in terms of the chemical characteristics of genic materials. It is to be expected that future results will confirm or invalidate our conclusions or lead to some modification of them. The present conceptual framework should, on the other hand, suggest a more logical design of experiments with genetic materials suited to such an analysis.

The past decade has witnessed the establishment of biochemical genetics as a legitimate discipline dealing with the genetic control of metabolism and of the general functions of the cell (Beadle and Tatum, 1941). The results clearly establish a close link between the genes and the cellular catalysts, or enzymes, regardless of whether the currently proposed "one gene, one enzyme" hypothesis is correct. We may expect, therefore, that in the future, information regarding the nature and mechanism of action of enzymes will be helpful in unravelling the mystery of the gene: its structure, reproduction, stability, and mode of influencing physiological and morphological characters. These are processes which require energy. The results of enzyme chemistry indicate that the protein portion of the enzyme may be more important in governing its mode of action than in simply accelerating the rate of a reaction, i.e., the protein surface is the critical site where metabolic energy is transported from one molecule to another. For example, in the oxidation of a compound represented as AH_2, the energy released might be present in an A-protein complex which could then be utilized by other reactions in a synthetic manner. If phosphate splits the complex, as in many known examples, the energy will be transferred to a new organic ester, A~P (Lipmann, 1941). The high energy content of such a complex (i.e., an A—protein complex) permits A to be added to other cellular components, such as B, to make a more complex molecule, AB, etc. Transference of this concept to the gene itself provides an avenue of approach to further study of the nature and mechanism of action of the gene. In this sense it is the configurational state of the gene which enables it to trap metabolic energy and cellular substrates in a manner which would then lead to the synthesis of essential components required for a specific process. A mutant gene, differing in geometry or constitution from the original gene, would be unable to perform that identical function, and the metabolism of the cell would be altered accordingly. If this led to a recognizable physiological or morphological trait, inherited in the usual mendelian fashion, the changed state would then achieve a mutant status. If the reaction were enzymatically catalyzed, the presence or absence of the enzyme would therefore not necessarily be perfectly correlated with the presence or absence of a particular reaction. However, since some relationship between genes and enzymes must exist, and since all reactions governed by enzymes have definite and describable rates, it is to be hoped that the ideas outlined here may suggest approaches in technique and interpretation which will be of value in the final interpretation of gene mutation.

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NEW BIOLOGICAL BOOKS

The aim of this department is to give the reader brief indications of the character, the content, and the value of new books in the various fields of Biology. In addition there will occasionally appear one longer critical review of a book of special significance. Authors and publishers of biological books should bear in mind that THE QUARTERLY REVIEW OF BIOLOGY *can notice in this department only such books as come to the office of the editor. The absence of a book, therefore, from the following and subsequent lists only means that we have not received it. All material for notice in this department should be addressed to H. B. Glass, Associate Editor of* THE QUARTERLY REVIEW OF BIOLOGY, *Department of Biology, The Johns Hopkins University, Baltimore 18, Maryland, U. S. A.*

ON UNDERSTANDING PRESIDENT CONANT

By JANE OPPENHEIMER

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A Review of SCIENCE AND COMMON SENSE.
By James B. Conant. Yale University Press, New Haven; Geoffrey Cumberlege, Oxford University Press, London. $4.00. xii + 371 pp.; ill. 1951.

Here is a book of admitted importance to the contemporary world of literature. Both because of the timeliness of its content and because of the prestige and intellectual distinction of its author, it seems deserving of some of the extravagant praise which has been lavished upon it by general reviewers.

The book represents an attempt to provide its readers "with some understanding of the way in which physicists, chemists, biochemists, and experimental biologists tackle their problems and some knowledge of how their efforts are related to progress in technology, agriculture, and medicine." It has been written in the conviction that "being well informed about science is not the same thing as understanding science, though the two propositions are not antithetical. What is needed is methods for imparting some knowledge of the tactics and strategy of science to those who are not scientists."

President Conant endeavors to show (hence his title) that "there is a continuous gradation between the simplest rational acts of an individual and the most refined scientific experiment. Not that the two extremes of this spectrum are identical. Quite the contrary: to understand science one must have an appreciation of just how common-sense trials differ from experiments in science."

He defines science "somewhat as follows: Science is an interconnected series of concepts and conceptual schemes that have developed as a result of experimentation and observation and are fruitful of further experimentation and observations," and he stresses continually the fact that "an understanding of the intricate relationship between concepts, conceptual schemes, and experiments is the essence of understanding science."

If a cat can look at a king, perhaps a daughter of old Eli may presume to regard the President of Harvard University and his thought in an attempt to see how closely he has approached his self-appointed target.

President Conant seems to be particularly fortunate in his appraisal of the contributions of deductive and inductive thinking to the formulation of concepts and conceptual schemes (though to question a historical point, I wonder to what degree his emphasis on the importance of deductive reasoning in the 17th century obscures the role that the reaction against Aristotelian deductive logic played in stimulating the return of the men of the Renaissance to the primary materials of nature). He is one of the very few among his contemporaries to interpret sanely and with lucidity the significance of quantification and measurement in modern science. His most stellar achievement may seem, however, to those among scientists and philosophers who may be sufficiently certain of their own convictions to agree with him, to be his development of the theme that "there is no such thing as *the* scientific method. If there were, surely an examination of the history of physics, chemistry and biology would reveal it. For as I have already pointed out, few would deny that it is the progress in physics, chemistry, and experimental biology which gives every one confidence in the procedures of the scientist. Yet, a careful examination of these subjects fails to reveal any *one* method by means of which the masters in these fields broke new ground."

"One can only emphasize," he writes in discussion of the importance of both qualitative and quantitative reasoning and experimentation, "that the history of

modern science shows there is no one method, no one sure road to progress; at one period advance is rapid by one group of procedures, at another time by another."

A major portion of the volume devotes itself to a detailed and exhaustive presentation and consideration of data to support these conclusions. These are dealt with by the "case history" method, and here there are a few remarks to be made in digression.

No justification is necessary, by President Conant or any one else, for the presentation of a series of "case histories." Any one who has ever known or thought enough so that he has had more to say than time has permitted on a particular occasion has been confronted with the obligation to select the material to be presented as examples to illustrate his generalizations. This was precisely Claude Bernard's procedure in an earlier analysis than President Conant's of the nature of experimental science, and I doubt whether Bernard is the first to have antedated President Conant in this respect.

Just as there is no need to justify this practice, so there is no necessity to label it by a new name, within or without quotation marks, and indeed there is a peril in so doing. Temptation is thereby offered to the imitators of the master, who presume to acquire merit by the simple expedient of using what they call the case-history method, specifically labelled such, as though the new method, made magic by virtue of having been named by President Conant, had imparted to their thinking a quality not inherent in it. This is one evident danger in the emphasis on teaching techniques which the present interest in general education is encouraging; namely, that those a little less bright than the writers of the reports believe they make education general by following a few named mechanical rules, forgetting that the truly enlightened teacher has known the importance of the general throughout the entire course of history. Neither Plato nor Goethe, for instance, had to wait for the publication of a report by a Harvard Committee to take a broad view of things. The recent discussions on general education have played their great service in drawing to the surface in our minds questions that were moiling about below; but they cannot answer them by anything so superficial as catchword labelling of formal pedagogical practices.

To abandon, however, the matter of techniques and to return to the more vital core of content: President Conant has found it expedient, in analyzing the present relation of science to technology and medicine, "to use the term 'degree of empiricism' to indicate the extent to which our knowledge can be expressed in terms of broad conceptual schemes," and he has pointed out that "the degree of empiricism in a practical field today largely depends on the extent to which the corresponding scientific area can be formulated in terms of broad conceptual schemes." President Conant, then, can be considered to be successful in his aims in measure as he has brought the layman toward a full understanding of what a concept is, and what a conceptual scheme.

I submit that this is a difficult goal to attain in the ultimate (quite aside from the question, which must also remain open, as to the degree of understanding that can be attained in the absence of participation).

In the first place, many scientists themselves, as I believe President Conant has admitted, find a certain difficulty in understanding the nature of a scientific concept, and it has been said that too many scientists are currently too little preoccupied with concepts. One eminent investigator, who is suffering the throes of editing a major compendium designed to deal with concepts in his own special field, has complained to me bitterly, time and again, that some of his contributors, supposedly chosen for high excellence in their field, lack all conception of what a concept is. If this is a real difficulty for the scientist, can it be a lesser for the layman?

Percy the office boy, who is *quite* an intelligent layman, reports that he found the going a little rough in spots in President Conant's book, and the foregoing may be part of the reason. Some of the less fluent passages in President Conant's prose seem to be characterized by a kind of self-consciousness which may represent in itself an unconscious admission that this difficulty is a real one. This emerges not only in such explicit statements of apology as the introductory sentence to his chapter entitled, The Origin of a Conceptual Scheme: The Chemical Revolution. "There is no mathematics," he writes, "in this chapter: nonetheless, the reader who knows little or nothing about science may find it difficult." It also appears as revealingly in the overtness of some of his verbal emphases; there is perhaps too much calling of concepts and conceptual schemes by the names of concepts and conceptual schemes, and too little letting them speak for themselves as demonstrative of what they are.

The author, for instance, makes the following statement: "Of course, the concept of the function of an animal organ such as the heart is far less general and abstract than the concept of a sea of air; and both are much nearer common-sense ideas than such a conceptual scheme as the atomic theory or the concept of a caloric fluid." This is an interesting argument to a scientist and a useful one, but I suspect it may be difficult for some laymen and even for some scientists to follow it to its logical conclusions. I am not certain that every layman can develop the capacity to appreciate such distinctions, even if it were necessary (and this I am not certain of either); and I refuse to believe that it is undemocratic to keep an open mind as to whether all minds may be equally sympathetic to abstraction or find equal pleasure and ease in coping with it. I suspect further that this is a point on which more evidence might well be collected by some of those who are so ardent to purvey their intellectual wares to the layman.

This is not to deny that there are many laymen who will profit by the author's statements exactly as they stand. I believe that President Conant has helped the layman to achieve the goal that he has set for him, and that he has given him an idea, and a good one, of the tactics and strategy of science. One further question, however, demands to be raised: is the message that President Conant has chosen to present to the layman the primary and fundamental idea that the scientist wishes to convey to him? Is it or is it not relevant to comment, to borrow President Conant's own metaphor, that no analysis of the tactics and strategy used at Ticonderoga or at Yorktown suffices to recreate the spirit of the American Revolution?

Before the scientist can arrive at a final decision regarding what he has to say to the layman, it behooves him to examine his purposes in speaking at all, and it is in this respect precisely that the scientist exhibits his most palpable weakness. President Conant has made very clear his idea of the limitations of what science contributes to the citizen: "To claim that the study of science is the best education for young men who aspire to become impartial analysts of human affairs is to put forward a very dubious educational hypothesis at best. Indeed, those who contend that the habits of thought and point of view of the scientist as a scientist can be transferred with advantage to other human activities have hard work documenting their proposition." On the positive side, however, his statement is not so strong: "Since scientific investigations provide widespread and often dramatic examples of an effective way of handling problems, a greater knowledge of the genesis of scientific methods ought to be imparted by our schools and colleges. Today the artificial restraints under which the experimentalist now unconsciously operates make cold-blooded factual analysis almost a routine operation, and the demonstration day after day of the success of such methods has profoundly influenced public opinion. To be properly understood, this demonstration, which strengthens other rational elements in our civic life, must be seen as the consequence of a sociological process whose history we can trace for at least three centuries. In addition to understanding something about the methods of science, a citizen needs to understand the operations of science as a human enterprise." This is not enough.

The Report of the Harvard Committee considered that "democracy is the view that not only the few but that all are free, in that every one governs his own life and shares in the responsibility for the management of the community. This being the case, it follows that all human beings stand in need of an ampler and rounded education." It specifies later the particular abilities which such education should seek to develop: the abilities "*to think effectively, to communicate thought, to make relevant judgments, to discriminate among values.*" Neither the Report of the Harvard Committee nor President Conant's book have yet made explicit the exact role that an understanding of science must play in the development of these abilities.

It is perfectly true that, as President Conant has said, "if a layman is to have any clear ideas about the relation of the methods of physics, chemistry and biology to education or to the investigation of human problems, he must understand the methods in question." Of course it is necessary to know what science is before its relationships can be appreciated. But may it not be that only when science is understood in its interrelationships that its own nature can emerge; indeed, is not this one implication of the whole program of general education? Knowledge of the degree to which freedom is a part of science, and to which science is a part of freedom, involves problems which have not yet been fully formulated. Freedom is more than exemption from restraint: it is, or it can be, a force for positive action. It has been said by an earlier Terry Lecturer that "research is the response to curiosity, not to need." The relationship of this curiosity to the mind's sphere of action in a free civilization still requires exploration by much hard thinking. This is a problem that always involves the layman quite as much as the specialist, but particularly at this moment, when education within curricular walls is looking toward decline, it is especially urgent to consider it with the layman in mind. It is to be hoped that President Conant's book will stimulate some further thoughts in this direction, and some profounder ones than have yet been expressed.

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GENERAL BIOLOGY: PHILOSOPHY AND EDUCATION

SCIENCE AND ENGLISH POETRY. *A Historical Sketch, 1590–1950. The Patten Lectures, 1949, Indiana University.*

By Douglas Bush. Oxford University Press, New York. $3.50. x + 166 pp. 1950.

In a beautifully written series of essays, Professor Bush of Harvard University has sketched the concern of English poets with science from Elizabethan times to the present. He traces the impact of the new science on the seventeenth century poets, considers the involvement of Newtonianism with rationalism and sentimentalism, and dwells on The Romantic Revolt against Rationalism in the age that followed. Evolution and the Victorian Poets is a natural sequel that finally leads to the era of Modern Science and Modern Poetry. It is Bush's dictum that "all modern poetry has been conditioned by science, even those areas that seem farthest removed from it. And though modern poets have been united in revolt against the positivistic and mechanistic habit of mind and the world it has created, they have of course revolted in very different ways and directions." Witness Thoreau and Whitman; Robert Frost, Archibald MacLeish, and Robinson Jeffers; Robert Bridges and D. H. Lawrence; Yeats and Eliot. There is so much insight and inspired penetration in these all-too-brief essays that perhaps no one should cavil. Yet it will be well to warn the reader that he may find the essays over-selective rather than comprehensive. Bush does not write of literature like Taine. Particularly in the essay on Evolution and the Victorian Poets, it is rather surprising to find, beside the fine treatment of Tennyson, Arnold, and Hardy, only a scanty glance at Browning and no mention whatsoever of Swinburne, whose "Glory to Man in the highest! for Man is the Master of things" epitomized the Victorian attitude toward Darwinism. The book unfortunately lacks an index.

BENTLEY GLASS

THE PROBLEM OF KNOWLEDGE. *Philosophy, Science, and History since Hegel.*

By Ernst Cassirer; translated by William H. Woglom and Charles W. Hendel, with a preface by Charles W. Hendel. Yale University Press, New Haven. $5.00. xviii + 334 pp. 1950.

Ernst Cassirer's beautifully written and profound analysis of the growth of 19th century mathematical, physical, biological, and historical thought should be read by every thoughtful biologist. Part II, especially, contains penetrating discussions of The Problem of Classifying and Systematizing Natural Forms; The Idea of Metamorphosis and Idealistic Morphology: Goethe; Developmental History as a Problem and a Maxim; Darwinism as a Dogma and as a Principle of Knowledge; Developmental Mechanics and the Problem of Cause in Biology; The Argument over Vitalism and the Autonomy of Living Organisms.

JOHN R. GREGG

THE WORKS OF GEORGE BERKELEY, BISHOP OF CLOYNE. *Volume II.*

Edited by T. E. Jessop. Thomas Nelson & Sons, London, Edinburgh, Paris, Melbourne, Toronto, and New York. 30s. viii + 294 pp. 1949.

For biologists who are interested in the philosophy of science and the theory of scientific knowledge, this volume is a definitive new edition of a work of immense importance. The worthy Irish bishop who dared to question the existence of anything material that could not be perceived—"esse is percipi" was his frequently repeated text—was the wellspring of Hume's theory of knowledge, which in turn has been the source of almost all significant thought on the subject right down to Bertrand Russell and Einstein. Berkeley's views, in a more direct transposition, found their way into the psychological views of Ernst Mach, whence came in turn much of the scientific outlook of W. K. Clifford and Karl Pearson. It is very interesting to compare Berkeley's *Principles of Human Knowledge* with Chapter II of Pearson's *Grammar of Science*. The latter may be, as President Conant has said in his recent book *On Understanding Science*, a very misleading book respecting the nature of *science as method*, but many scientists of today can testify to its stimulating influence upon them in the consideration of *science as knowledge*.

Many readers may prefer the *Three Dialogues* to the *Principles*, on account of their interesting argument, wit, and clarity. They offer a lengthier but more charming exposition of the same ideas. It is excellent to have both works in the same volume. The *Philosophical Correspondence with* (the American) *Samuel Johnson* offers further argument and exposition of Berkeley's ideas.

BENTLEY GLASS

WELTSCHÖPFUNG *in Mythos und Religion, Philosophie und Naturwissenschaft. Glauben und Wissen, No. 4.*

By Bernhard Bavink. Ernst Reinhardt, Basel. Sw.Fr. 4.80 (paper); Sw.Fr. 6.60 (cloth). 126 pp. 1950.

After a short but competent survey of religions and philosophical theories of creation, the author examines the scientific cosmogonies from Kant and Laplace to von Weizsäcker and Pascual Jordan. For a better understanding of the latter the author discusses also modern nuclear physics.

The little book is very well done, full of information and ideas, and yet readable. The late Bernard Bavink was a philosopher as well as a mathematician. Like his friend Max Planck he believed in a very transcendent mathematician's God, but opposed the mixing of theology and science.

ERWIN H. ACKERKNECHT

NATURE AND HISTORY. *Woodbridge Lectures Delivered at Columbia University, 1949. Number 3.*

By Sterling P. Lamprecht. Columbia University Press, New York. $2.50. xiv + 155 pp. 1950.

Lamprecht's cultured and charmingly interminable discourse on such assorted topics as Causality, History and Physics, and the Natural Bases of Freedom and Happiness, will not necessarily repay the reading of it.

JOHN R. GREGG

SCIENCE AND THE MORAL LIFE.

By Max C. Otto; preface by Eduard C. Lindeman. A Mentor Book; New American Library of World Literature, New York. 35 cents. viii + 192 pp. 1949.

This book contends that pure science is ethically neutral. Social living is said to be an art, not a science. It is said to be possible to discover some of the key categories, or orientational ideas, in the light of which certain norms for art may be stated, if only in a tentative or hypothetical way.

Max Otto would defend a "realistic idealism." The art of social living is not an art of compromise. Broader objectives than those now visualized by conflicting groups may be established by a creative type of thought with some characteristics in common with science and some characteristics in common with poetry. The author also believes that a sense of common doom can have a highly moralizing effect. I take it that this would be a phenomenon no less poetic than that hope which arises together with the thought that nature, considered in its infinite range, is fecund with possible variations, including ideal variations, upon all its recognized themes.

Perhaps the difficulty which Max Otto seems to experience in his quest to construct an affirmative philosophy is a consequence of that utilitarianism of John Stuart Mill and of John Dewey which establishes for him most of his presuppositions. Is the "Wisconsin Idea" which also inspires him able to break out of this heavy shell of all too obvious utility and to represent clearly a universal culture which shall be inspired by the contemplative virtues as well as armed by technology?

ROBERT F. CREEGAN

PHILOSOPHY FOR THE FUTURE. *The Quest of Modern Materialism.*

Edited by Roy Wood Sellars, V. J. McGill, and Marvin Farber. The Macmillan Company, New York. $7.50. xiv + 657 pp. 1949.

Some 27 writers have contributed to this volume, but it would be unfair to say that as many as 27 distinct philosophies are set forth. Perhaps half a dozen distinct and in most cases clashing philosophies are offered here under the rubric of "Materialism."

The various writers agree more in regard to beliefs they reject than in regard to those they affirm. Many of them contend that human happiness depends almost entirely upon "control" of nature. In other words, the contemplative virtues are rejected in favor of technological and executive skills. Man is said to be creative but not to learn from creative encounters. Man, the hero, is depicted as striving against an otherwise rather insignificant nature.

There is also a large measure of agreement upon the proposition that the beginning of things was matter in its least organized condition. One wonders what right a materialist would have to speak of a "beginning?" In a materialistic system, time would have to be either infinite or circular. There could be no beginning. Each cycle of development or of retrogression would have to be conceived as having been preceded by some other cycle, as well as being followed by some other cycle. The concept of a beginning is borrowed unconsciously from creationism. Hence all statements as to the earliest character of things are out of place, that is, logically irresponsible, within any materialistic system of thought.

An important minority of the contributors feel that a purposive world would somehow justify social oppression and exploitation. We must all be accidents in the cosmos so that we may all be equal. As George Orwell pointed out in his novel, *Animal Farm*, the concluding step in this sort of logic is the discovery that some of us (the commissars) ought to be just a little bit more equal than others.

Several of the essays in this volume are worthwhile summaries of recent findings in various branches of science, mathematics, or methodological philosophy. Therein resides the positive value of the book. The metaphysical position is presented and defended in a manner so tendentious, and at the same time so careless, that we decline to take it seriously.

ROBERT F. CREEGAN

SCIENCE AND THE GOALS OF MAN. *A Study in Semantic Orientation.*

By Anatol Rapoport; foreword by S. I. Hayakawa. Harper & Bros., New York. $3.50. xxx + 262 pp. 1950.

This is a difficult book to review, because, in my opin-

ion, the only way to understand fully Rapoport's theme is to follow its development by reading the book from cover to cover. His central theme is the following: There are certain "preferences" or "values" inherent in the scientific outlook, even though many and perhaps most scientists do not recognize them, and these "values" could be made to serve as "goals" to which all mankind could subscribe, to the immeasurable benefit of all.

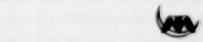
S. I. Hayakawa, in a Foreword, summarizes the "preferences" or "values" inherent in the scientific outlook, according to Rapoport, in somewhat this fashion: (1) scientists "prefer" a nonpartisan and general view to one colored by private or provincial "obsessions"; i.e., scientists are "prejudiced" against prejudice; (2) scientists prefer truth-telling to lying; (3) they prefer statements capable of verification to those that must be taken on authority; and (4) they prefer logical order to a chaotic assemblage of facts. In Chapter 22, Is Science Moral?, Rapoport says further: "A fundamental value in the scientific outlook is concern with the best available map of reality. The scientist will always seek a description of events which enables him to predict most by assuming least. He thus already prefers a particular form of behavior. If moralities are systems of preferences, here is at least one point at which science cannot be said to be *completely* without preferences. Science *prefers* good maps."

The book opens with a Prologue and ends with an Epilogue, both of which consist of conversations "In the Office of Dr. S." These conversations, uncannily well-imagined, take place between a physicist, a mathematician, and a social scientist. They serve two purposes, to state clearly the problem and conclusions involved in the book and to remove the theme to some extent from the handicap of "emotion-weighted words," which in these days so often block a scientific discussion of many problems. The latter is done by the use of such expressions as these: "—my staff and I have been working on the *parapetacular properties* of *transgallium*" and "—in *Plutopolis* and in *Neptune*, in *X-ville* and in *Y-ville*" [italics added].

Science and the Goals of Man is stimulating reading. It must be read to be appreciated. Perhaps the quotation of a few chapter titles will give some impression of the challenge of the book. What Happens When People Disagree? is the opening chapter—a fine one. Others: Whom Do You Believe? What Do You Believe? What Do You Mean? What Metaphysics Do You Use? Are Logical Positivists Idealists? Are Semanticists Fascists? How Certain Is Certain? Is Science Enough? Every chapter abounds in explanatory examples, and the whole is written in direct, nontechnical language.

As Hayakawa says, the book "provides inspiration and provocation to everyone who has asked himself the great question which our almost universal faith in progress leaves unanswered, 'Which way *is* forward?'"

ELLA THEA SMITH



SCIENCE FOR PEACE AND SOCIALISM.

By J. D. Bernal and Maurice Cornforth. Birch Books, London. 2s. 6d. (paper). 86 pp.; ill. [No year].

The authors of this work have made an honest effort to steer an impartial course between absolute accuracy on the one hand and absolute inaccuracy on the other. They seek to appraise modern trends in the study, teaching, and application of science and the scientific method, as these in turn are affected by political developments in the international situation, which they see largely as a struggle between the capitalistic economy of the United States and the so-called Socialism of the Soviet Union.

According to the authors, capitalism as it exists in the United States is based upon the exchange of cash for commodities. When either of these becomes exhausted capitalism can no longer function. Today there is ample evidence of the rapid depletion of both. The reason for the exorbitant taxation to which United States citizens are subjected is not entirely due to the real or imaginary need for additional revenue by the government, although this is one factor. Government officials are quite frank in admitting that a further purpose is to limit the purchasing power of the public, which, of course, would lower its standard of living. The entire revenue acquired by the state through excessive taxation is not put back into circulation; much of it is used to finance past and future wars, the effects of which are wholly destructive.

In the period between the two world wars the government confiscated all privately owned gold and put it into subterranean storage, at the same time cancelling all paper money redeemable in gold, without, however, legally abolishing the gold standard. But the price-fixing hysteria during the past decade had the result of virtually substituting for the gold standard one based on the caloric value of groceries, and the resulting economy, whatever it may be called, is certainly not capitalism.

Furthermore, the commodities available for commercial exchange are themselves becoming rapidly depleted. The first of these was the fundamental one, the land. The time has now passed when the victim of the capitalistic competition could move 50 miles west, clear a few acres of virgin soil, and begin life anew. There is no productive soil left in the public domain.

The depletion of personal property is not yet evident in the retail stores, but that it is on its way is indicated by the fact that the retail price of diesel oil has tripled in the past decade and that the Standard Oil Companies find it necessary to make large purchases of

crude oil in foreign fields to keep their refineries going. This course is disturbing to world stability, not only because it deprives some of the more backward nations of the resources required for their own development, but because it tends to make them politically as well as economically dependent upon the United States.

Much as the smaller nations fear the aggression of the capitalism of the "Colossus of the North," they fear its collapse even more, for they perceive that such an event would probably be succeeded, not by a new economic system, but by economic chaos. They are like the Lilliputians who, while they feared the inroads being made in their domestic economy by Gulliver's appetite, feared even more the pestilence that would arise from the decomposition of his corpse if they should kill him. The dilemma which confronts the smaller nations seems to be the choice between degradation through submission to capitalistic imperialism or annihilation through opposition to it.

The only way out, as the authors see it, is the establishment of a new economic system which can take charge upon the collapse of capitalism. This they believe to be imminent, and look to socialism to fill the need. But unfortunately economic systems cannot be formulated to order. They must grow.

At this point Bernal and Cornforth lift up their eyes to the hill of the Kremlin, whence they expect help, though their hopes are as vain as those of the priests of Baal who prayed for a bolt of lightning to ignite the sacrifice on their altar. The Union of Soviet Socialist Republics is socialist in name only, just as its sole political party is communist only in name. When a communist secures for himself wealth and power he realizes that the means by which he obtained them from his predecessors may be invoked by his successors to take them away from him, and so he ceases to be a communist in fact, and remains one in name only. What a socialist might do if he suddenly succeeded to prestige and influence we may see in Great Britain, where a serious effort has just been made to establish a scientific economy based on socialism. The authors of this work are presumably British citizens, but they are like the well-known characters for whom the grass always seems to grow greener on the other side of the fence, while they ignore the opportunities afforded by their own backyard. They have chosen to follow the *ignis fatuus* of false prophets, Marx and Engels in economics and Michurin and Lysenko in science, whom they try to whitewash, instead of taking for their guide the torch raised by those truly great prophets of their own country, John Lilburn and Gerard Winstauley, John Bellers and Robert Owen.

SECURITY, LOYALTY, AND SCIENCE.
By Walter Gellhorn. Cornell University Press, Ithaca, New York. $3.00. x + 300 pp. 1950.

This is a timely and well formulated study of a painful subject, one which many of us would rather pigeonhole in favor of the more tractable specialties. However, ere we ourselves are pigeon-holed by non-discriminatory events, we would do well to consider the implications of Gellhorn's sane and well documented analysis of the governmental policies of secrecy in matters of scientific research. The setting from which the policies emerged is presented, and the results of their application, both as to their over-all effect on the health of American democracy and as to their special effect on the progress of science. Gellhorn draws up a thoughtful "balance sheet of secrecy," from which he concludes that secrecy regarding scientific developments may well cost the nation much more than it benefits us. "No matter how fleetingly unpopular it may be to do so, one cannot too often stress that strength lies only in a dynamic rather than a static utilization of resources." Secrecy, then, in the present context, may be conceded as having proper but very restricted limits. However, extension of "loyalty" or "orthodoxy" tests to scientific personnel who are "factually, officially and unqualifiedly barren of state secrets" is quite another matter. "Ebullience and unorthodoxy may not be absolute prerequisites of scientific brilliance, but they are certainly compatible with it and probably accompany it more often than not. Authoritarianism is by definition inconsistent with intellectual creativeness. . . . The entire history of science has been one of battle against orthodoxy—against the orthodoxy of the church, the orthodoxy of dogmatic conviction and intuitive knowledge, the orthodoxy of the social, economic, and political opinions of the moment. Although the habit of doubting the perfection of things as they are may sometimes be indulged in unwisely, it is almost a necessary attribute of those who contribute to the progress of science. The scientific drudge may live untouched by the turmoil of ideas. The scientific creator is likely to be broadly cultured, complex, alert, and unafraid of the unconventional. Too many men who possess those characteristics are today avoiding work for which clearance must be sought, or are being passed over in favor of more pedestrian spirits. . . ."

"One of the virtues of democracy is its maintenance of a climate in which normally timid persons are allowed to entertain opinions without having to demonstrate heroic qualities. . . . The loyalty program drifts in the direction of curtailing that freedom." In addition to a detailed and eloquent indictment of the basis of the "loyalty" program, Gellhorn discusses case after case of its procedures, which only too often involve trial by hearsay and scandalous abrogation of those traditional judicial and legal principles which reflect the hard-won wisdom of our cultural heritage.

However, there are certain encouraging notes. One is the refusal of the National Academy of Science and the National Research Council to administer the fel-

lowship program for the Atomic Energy Commission since FBI investigations were required for scientists not engaged in secret work. Another is that "not a single one of the scientists involved in clearance proceedings during the years . . . since World War II has been found to be a spy, either amateur or professional. No basis appears for manifesting an especially distrustful attitude toward American men of science. The House Committee on Un-American Activities has sought, perhaps successfully, to create contrary impressions. Analysis of their reports demonstrates, however, that their substance is slight indeed."

Gellhorn's position is well summarized in a short chapter entitled *Concluding Thoughts* wherein he finds that "without either minimizing the demands of national security or magnifying the perils of our present course one can soberly urge re-examination of the measures now enforced." In short, "the welfare of the humans who populate the United States deserves advancement by instrumentalities other than munitions. . . . Courageous men have acknowledged error in the past. Courageous men will do so in the future." But not, perhaps, without a certain encouragement from the normally timid citizenry.

EVELYN HOWARD

OUR ATOMIC HERITAGE.

By Arnold B. Grobman. University of Florida Press, Gainesville. $2.95. xiv + 147 pp.; ill. 1951.

We are all painfully aware that atomic energy in a man-manipulated form is with us to stay, whether we wish it so or not. It therefore behooves the thinking public to acquaint itself as best it can with the far-reaching consequences of this latest of scientifically controlled forces, not only for peace of mind but for the understanding and appreciation that of necessity must precede the weighted judgment that leads to beneficial control and utilization as determined by legislative bodies. At the present time, and in the minds of the general public, the destructive aspects far overshadow the benefits which are being, and will continue to be, derived from atomic energy and its byproducts, but it is hoped that a proper balance can be struck. This is the task undertaken by the author, and his hoped-for audience is the general reading public. Arnold B. Grobman, a herpetologist by inclination, and a radiobiologist during the period of the Manhattan Project, approaches the problem in a dispassionate fashion, and succeeds in presenting in readable form the constructive and destructive aspects of atomic energy. The author wisely refrains from a discussion of the military question of atomic warfare, a question raised by expediency and answerable only in terms of expediency. The book itself is divided into what the author chooses to call the four heritages: hereditary abnormalities which any ionizing radiation can induce, isotopes in scientific research, energy for industry, and, lastly, THE BOMB and its effect on populations. The discussions are elementary, as indeed they should be, but the points are well made, and the result is an informative and provocative book which should be widely read. The scientist will find little in it of technical value unless he desires it as a source book for public lectures on radiobiology.

C. P. SWANSON

TEACHING BIOLOGY FOR APPRECIATION.

By Alfred F. Nixon. Chapman & Grimes, Boston. $3.00. 147 pp. + 16 pl. 1949.

This little book was written to encourage teachers in secondary schools to modify their biology teaching "in the hope that such modification may be conducive to its [biology] playing a more important role than it now does. . . ." The book deals first with appreciation, its meaning, development, need and significance, and second with biology in relation to art, literature, and social studies. In the three chapters on appreciation there are about forty-five quotations varying in length from a few lines to half a page. The latter part of the book deals largely with examples which illustrate how biology and the other studies can be made to interlock in the classroom.

It is my belief that biology as a science, and not a mere collection of facts for memorization, can make its way in any curriculum, provided its proponents have some depth of understanding of science and some active interests in science and culture. On a moral basis one can expect such qualities in a biology teacher at any level. Where they exist there is seldom a problem in teaching for appreciation. Where they do not exist there lies a major problem in education, which this book may, or may not, help to solve.

RALPH LEWIS

BIOLOGY IN REVIEW.

By Phil R. Gilman and Vincent R. Peterson. Lyons and Carnahan, Wilkes-Barre, Pennsylvania. 75 cents (paper). 405 pp.; ill. 1949.

This simply written handbook contains a great deal of biological information arranged for the purpose of a quick review of the subject. It would scarcely suffice for a real introduction to the principles, rather than the facts, of biology. The standard of factual accuracy is fairly high, although one meets with a weirdly incorrect account of mitosis, misspellings of some scientific names, and a good deal of lack of precision due to over-condensation. A high school student with a good textbook will scarcely need such an aid. It is mainly for those who have to review for some state or college entrance examination.

AN INTRODUCTION TO BIOLOGICAL PRINCIPLES. *Laboratory Studies and Their Interpretations.*

By Paul A. Meglitsch and John P. Wessel. Burgess Publishing Co., Minneapolis. $4.00 (paper). xii + 273 pp.; ill. 1948.

A laboratory manual for a full year course in biology. Emphasis has been placed on the attainment of unity through the development of major concepts and principles involving a relatively few selected animals representing 5 levels of body plan. The gross anatomy, histology, and physiology are closely correlated. A profusion of drawings and diagrams to be labeled is provided. The second part of the book deals with phylogenetic concepts, ecology, embryology, and heredity. On the whole, little is required of the students beyond observing and then labeling. In many parts the manual virtually becomes a textbook.

ADAPTATION.

Edited by John Romano. Cornell University Press, Ithaca, New York; Geoffrey Cumberlege, Oxford University Press, London. $2.00. xiv + 113 pp. 1949.

The 5 essays in this book were originally presented at the dedication of a new psychiatric unit of the Strong Memorial Hospital, of the University of Rochester School of Medicine and Dentistry. They represent the views of adaptation of an embryologist, a physiologist, a psychologist, a psychiatrist, and an anthropologist. It is little wonder that the concept, seen from such diverse points of view, undergoes a striking metamorphosis. The contributors, however, have something worth saying, and the result is a volume stimulating beyond the expectation aroused by its slender size.

Paul Weiss, in discussing The Biological Basis of Adaptation, emphasizes the significance of the distinction between adaptedness and adaptability, and the importance of "the duality of fitness—approximate fitness by evolutionary predesign, elaborated to greater perfection and precision of fit by direct on-the-spot adjustments." The most specific of all direct adaptations are to be seen in the molecular realm, in the specificities of antibody formation and the adaptive enzymes. "The latitude left to direct adaptation is extremely narrow as compared to the wealth of inherited adaptedness of evolutionary origin. The only system in which this margin has reached a maximum of truly imposing dimensions is the brain."

Homer W. Smith contrasts Organism and Environment: Dynamic Oppositions. Like Paul Weiss, he sees in homeostatic mechanisms and other aspects of "ontogenetic adaptation . . . only a subchapter of phylogenetic adaptation." He conceives of "life as some whirlpoollike deflection of energy which has beat its way up the long road of evolution, into every organismal reaction, into every homeostatic state, in every adaptation;" and thus comes to a conception of all response to stimulus as a manifestation of the basic property of protoplasm to restore itself to the status quo, to react against disturbance. Examining Sherrington's dualism of mind and matter, he rejects it for a monistic view that harks back to the standpoint expressed by John Tyndall in 1868.

Adaptation on the Threshold of Intelligence is the theme of Howard S. Liddell, who reconsiders Pavlovian conditioning. In the light of its potential traumatizing effect when vigilance is either thwarted or monotonously protracted, he concludes that experimental neurosis is invariably connected with "concealed vigilance" or "diffused vigilance" through overactivity of the parasympathetic or sympathetic portions of the autonomic system, respectively.

Lawrence S. Kubie, in discussing The Neurotic Potential and Human Adaptation, veered radically from the experimentally based conclusions of the other participants in the symposium to reason a priori that "behavior which is determined by unconscious processes is rigid and inflexible" in contrast to normal behavior, which is consciously motivated and "in the truest sense of the word free. . . ." The assumption which follows, namely, that unconscious behavior is necessarily abnormal and neurotic, seems very unsound from an evolutionary point of view.

It is a relief to get from this sort of speculation into the well-reasoned discussion of Clyde Kluckhohn on The Limitations of Adaptation and Adjustment as Concepts for Understanding Cultural Behavior. In earlier writings Kluckhohn has argued for "functionalism." This theme repeats, on the cultural level, what has already been expressed in some of the earlier discussions on the levels of the cell and organ as well as that of the individual—the concept, namely, of self-regulation in behavior that "tends toward a state of maximal integration or internal consistency." Functionalism leads to the view that the process of reducing tension is the primary or sole motivation. Kluckhohn now questions its validity. The individual may actually seek tension, novelty, excitement. Patterns of culture may find different standardized solutions of the same fundamental problems of human adjustment to the environment. These two phenomena, the one individual, the other social, cannot readily be regarded as merely "appropriate responses to the special character of each particular environment." Beyond the level of adaptation necessary to survival there lies an extensive realm of "choice." It is moreover clear that in making such choices both individuals and societies not only are motivated by the need for homeostasis and limited by previous crucial choices that in part determine later ones, but are also affected by "the pull of expectancies as well as the push of tensions. . . . Growth and creativity come as much or more from instability as from stability, depend on culturally created values as well as the immediately observable

external environment." "Only in part is culture an adaptive and adjustive instrument." On this thoughtful note the volume ends.

BENTLEY GLASS

GENERAL BIOLOGY.

By J. E. Wodsedalek and H. L. Dean. Wm. C. Brown Co., Dubuque, Iowa. $3.00 (paper). vi + 257 pp.; ill. 1949.

A manual for a college course organized as a survey of the plant and animal kingdoms. Very little experimental work is included, and the emphasis seems to be mainly on structure and terminology. The manual contains numerous excellent labeled drawings, making it almost an atlas rather than a workbook for a student.

BIOLOGY LABORATORY MANUAL.

By A. M. Winchester. Wm. C. Brown Co., Dubuque, Iowa. $2.50 (paper). vi + 241 pp.; ill. 1950.

A laboratory manual for the college course in general biology, consisting of 36 exercises: 6 on the microscope, the cell, protoplasm, and photosynthesis; 6 on the plant kingdom; 3 on the anatomy of the seed plant; 10 on the animal kingdom; 9 on the physiology and anatomy of the frog; and 2 on genetics and embryology. The directions are simple and carefully prepared. Work sheets, which include many unlabeled drawings, are included. The manual is especially prepared to be used with the author's textbook, *Biology and Its Relation to Mankind*, but could well be used in conjunction with other textbooks.

TEACHING AGRICULTURE. *First Edition. McGraw Hill Series in Education.*

By Carsie Hammonds. McGraw-Hill Book Company, New York. $3.50. viii + 353 pp. 1950.

A book for future teachers of agriculture, this volume covers the various levels of instruction from elementary schools to colleges, as well as the different types of extension teaching. Teaching principles and devices are discussed in general, followed by an extension of these to particular levels of instruction.

NEW BIOLOGY 10.

Edited by M. L. Johnson and M. Abercrombie. Penguin Books, Harmondsworth, Middlesex; Baltimore. 35 cents (paper). 144 pp. + 16 pl.; text ill. 1951.

Contains: Famous Animals—3, Amoeba (M. M. Swann); The Biological Application of Isotopes (John E. Harris); On Apple Scars and Blemishes (Herbert and Mary Miles); Mimicry as Illustrated in the British Fauna (E. S. Brown); Instinct (John Carthy); The Life History of the Gannet (Richard Perry); Research Note—The Wetting of Leaves by Water (G. E. Fogg); Index to Volumes 1–10 by subjects and authors, and cumulative Table of Contents.

The very high standard of this publication is maintained in these issues. Teachers of biology in secondary schools as well as colleges who do not use these excellent articles to enliven their teaching and broaden their own knowledge and interest are truly overlooking an outstanding opportunity.

BENTLEY GLASS

BIOLOGY: HISTORY AND BIOGRAPHY

THE GROWTH OF PHYSICAL SCIENCE. *Second Edition. By Sir James Jeans. Cambridge University Press, New York and London.* $3.75. x + 364 pp. + 14 pl. 1951.

Jeans did not live to see his first edition of this work published in 1947. Since then, the publishers have undertaken to reissue it with certain corrections and additions. The volume, however, is still Jeans at his historical best, and, as those who are familiar with the first edition will attest, it remains an excellent and readable history of the continuous enlargement of physical knowledge from Babylon to Los Alamos, from the fumblings of the alchemists and astrologists to Einstein, Heisenberg, Planck, and Bohr. It is a book for the uninformed in physics, and succeeds in divesting physics of some of its unintelligible symbolism and making it understandable to those who would like, in a general way, to keep abreast of modern science and its historical background.

C. P. SWANSON

A HISTORY OF BIOLOGY. *A General Introduction to the Study of Living Things. Revised Edition.*

By Charles Singer. Henry Schuman, New York. $5.00. xxxvi + 580 pp.; ill. 1950.

This is a reprint of Singer's work which appeared at Oxford in 1931 as *A History of Biology*, and which was later reprinted in the United States as *The Story of Living Things*. Comments on the original work must be made briefly. These are indeed laudatory. Students of biology are fortunate that in 1931 Singer wrote, with a breadth of scope and with scholarship and skill which resulted in this remarkable historical

presentation of the development of the biological sciences.

The new edition was disappointing as a revision. Remembering well the 1931 edition, I looked forward to the enjoyment of seeing revisions and additions that would incorporate the outstanding developments in biology made since the beginning of the 20th century discussed by Dr. Singer. But the volume has remained, with some minor alterations and revisions, the same edition of 1931. Recent problems: chemical embryology, chemical genetics, endocrinology, immunochemistry, to mention examples, are not developed.

Two other criticisms must be made. Though each is perhaps minor, both are unexpected in a scholarly work. First, is Singer's practice of quoting original source material, and noting thereafter "abbreviated," "slightly abbreviated," "condensed," etc.; second, the lack of a subject index and a bibliography. In spite of these shortcomings, the reappearance of this excellent work, long out of print, is of great value.

M. C. SHELESNYAK

THE EPITOME OF ANDREAS VESALIUS. *Historical Library, Yale Medical Library Publication Number 21. Translated from the Latin with preface and introduction by L. R. Lind; anatomical notes by C. W. Asling; foreword by Logan Clendening. Macmillan Co., New York.* $7.50. xxxviii + 106 pp. + 25 pl. 1949.

The science of human gross anatomy, as we now know it, was created in the year 1543 when the *De Humani Corporis Fabrica Libri Septem* of Andreas Vesalius was published by the press of Oporinus in Basel. At the same time, Vesalius and Oporinus also published a shorter compendium, the *Epitome*. Numerous copies of the larger, greater work, many of them in excellent condition, still exist. Not so with the *Epitome*, however; of it perhaps a score of copies have come down to us. It is not difficult to understand the reason for this. The large, truly monumental and revolutionary *Fabrica* is crammed with tedious detail and erudition and is heavy going; whereas the little *Epitome* is a masterpiece of condensation and summary, sprightly by comparison—in other words, it is readable. The *Fabrica* would entice only the medical scientist and others of similar bent. The *Epitome*, however, would appeal to the Renaissance physician and suffice to supply him with the anatomical information he needed. Hence, while the *Fabrica* adorned the bookshelf, the *Epitome* was used to disintegration.

Lind has produced a very clear and scholarly translation, for which all students of Vesalius will be grateful. It may be noted that this is the first complete translation of the *Epitome* into the English language. The explanatory notes by Asling, appended to each chapter, are no less praiseworthy. Finally, the translation is followed by a photographic reproduction of the entire Latin text and its accompanying beautiful woodcuts (ascribed, like those of the *Fabrica*, to the artist Jan van Calcar).

The translator, the commentator, and the publishers are to be commended for having produced this excellent, useful volume, which will delight all lovers of Vesaliana.

W. L. STRAUS, JR.

JOHN RAY, NATURALIST. *His Life and Works. By Charles E. Raven. Cambridge University Press, New York and London.* $7.00. xx + 506 pp. + 1 pl. 1950.

This 1950 edition could be described more accurately, perhaps, as a second printing of the 1942 edition. A few small corrections and additions have been made in the text itself, but the longer Addenda have been collected on 3 pages as an Appendix. In spite of this mislabeling, the book has much to recommend it. In fact, it is the same excellent work which was received so enthusiastically when it first appeared eight years earlier.

The author, distinguished Master of Christ's College and Regius Professor of Divinity in the University of Cambridge, has many points of contact with the man whose life he has recorded. He is like John Ray in both profession and hobbies. He is a classicist, a theologian, and an expert field naturalist, competent in both botany and zoology. He differs from Ray in that he and Ray have their hobbies and profession practically reversed, for Ray's hobby ultimately became his true profession. In any case, it would be difficult to find a more competent biographer of Ray or one more expert in epitomizing and evaluating Ray's contributions to science.

John Ray was one of the pre-Linnean systematists whose work was soon eclipsed by that of the great Swede. The eclipse, while total, was not permanent; and now that we appreciate the real value of a natural system as contrasted with artificial systems, Ray's work is better appreciated. It is remarkable that we have had to wait for over 200 years after Ray's death before a comprehensive biography of him appeared. This one by Canon Raven seems definitive. The third edition will probably require as few emendations and additions as the second.

CONWAY ZIRKLE

BENJAMIN SILLIMAN *1779–1864, Pathfinder in American Science. By John F. Fulton and Elizabeth H. Thomson. Henry Schuman, New York.* $4.00. xiv + 294 pp. + 15 pl.; text ill. 1947.

Fulton and Thomson have given a straightforward and workmanlike account of the events of the life of Benjamin Silliman, Sr., and of his personality, scientific development, and accomplishments. A lawyer by training, Silliman became the first Professor of Chemistry at Yale. He subsequently inaugurated the study of mineralogy at Yale, and was influential in establishing the Peabody Museum of Natural History and in organizing the Yale Medical School. He founded the *American Journal of Science*, was the first president of the association of geologists which was later to become the American Association of Geologists and Naturalists and the American Association for the Advancement of Science, and he was a charter member of the National Academy of Sciences. He was the moving spirit in the development of the Department of Philosophy and the Arts out of which were to grow the Graduate School of Yale University and the Sheffield Scientific School, "both results [that] constitute Yale's greatest single contribution to higher education." His own greatest contribution was to establish graduate education in science in the United States on the firm foundation on which it has builded ever since.

Silliman was a frank utilitarian, a pragmatist, a popularizer, and always a teacher and administrator rather than a scholar in the strict sense. While he may have been unoriginal so far as direct contribution to research is concerned, he showed great imagination in his efforts to establish a scientific school at Yale and to set the standards high for graduate work in science, and he has thus exerted the widest possible influence on the promotion of all theoretical and fundamental work in American science in the years following his time. The authors have not chosen to measure duly the influence of Yale and of the Sheffield Scientific School on the development of science in America, but Silliman was a figure of sufficient importance to deserve far wider recognition than he has recently received. Fulton and Thomson have done a service not only to his memory but also to the public in presenting a modern biography of him.

JANE OPPENHEIMER

LOUIS AGASSIZ, SCIENTIST AND TEACHER. *Graduate School Studies. Education Series. Number 2.*

By James David Teller. The Ohio State University Press, Columbus. $1.50 (paper). xii + 145 pp. 1947.

It is good that teachers today examine closely the works of great teachers of the past, for out of such examinations may be gathered guidance and inspiration. It is with this in mind, and with a desire to assess Agassiz's influence as a teacher, that the present volume was written. The author discusses his subject under the following heads: Agassiz's education; his teaching and research in Europe; his educational activities in the United States; his manner and method of teaching; and his relation to the university spirit, to the museum, and to the summer school. The book makes clear that, in so far as one can judge, Agassiz's success as a teacher stemmed from his desire to be "the first naturalist of his time" and from his enthusiasm for the creation and dissemination of knowledge. There is little doubt that if more teachers possessed in greater measure these qualities, considerable progress in education would result. By writing this book the author has added to the possibility that teachers today may improve their art by appreciating the motivation, thoughts, and procedures of a master.

RALPH LEWIS

ROCKY MOUNTAIN NATURALISTS.

By Joseph Ewan. University of Denver Press, Denver $5.00. xvi + 358 pp. + 9 pl. 1950.

This is a regional guide to the naturalists who explored and collected in the Rocky Mountains. The first half of the book consists of informal but very informative biographies (each illustrated with a portrait) of Edwin James (1797–1861), John Charles Fremont (1813–1890), Charles Christopher Parry (1823–1890), Edward Lee Greene (1843–1915), Thomas Conrad Porter (1822–1901), Harry Morton Patterson (1853–1919), Marcus Eugene Jones (1852–1934), Eugene Penard (1855–), and T. D. A. Cockerell (1866–1948).

The second half of the volume is a roster of almost a thousand natural history collectors, some of whom have had a tenuous connection with the Rocky Mountain region. The author states that his aim was to identify such persons, both casual amateurs and professional collectors, and to give facts about their places of residence, occupations, and travels in the Rocky Mountains. Attempts were made to discover the full names and vital dates of all persons enumerated. More space was assigned to the relatively obscure naturalists, whereas those more prominent were treated more briefly, with references to sources where complete biographies could be found.

The author has succeeded in some excellent biographical detective work. He has investigated private letters, when possible, manuscript material, herbarium labels, etc. This result is of great but highly specialized interest. Systematists should find the roster very useful.

CONWAY ZIRKLE

HARVEY CUSHING—*Surgeon, Author, Artist.*

By Elizabeth H. Thomson; foreword by John F. Fulton. Henry Schuman, New York. $4.00. xviii + 347 pp. + 13 pl. 1950.

The life of Harvey Cushing (1869–1939), brain surgeon,

will always be good material for a biography. He was one of the great scientific surgeons of modern times, and one of the most eminent doctors America has produced. He was a notable book collector, and through the temporary marriage of one of his daughters to F.D.R.'s son James became involved in "history." He was adored by his patients. Among his colleagues he left less unequivocal memories, being even more ambitious and egocentric than most of them. As a personality he reminds one more of Dupuytren than of Larrey or Lister.

There are two general sorts of biographies. Those written shortly after the death of the hero, by his pupils or friends, contain numerous valuable personal data, but are hardly ever more than extensive eulogies. The second kind, the respectful but critical analysis of the man's work and personality, with most emphasis on the former, seems to be possible (as the excellent recent book of R. Dubos on Pasteur shows) only about 50 years or more after the master's death.

This well illustrated biography of Cushing definitely belongs in the first category. Much of it is interesting, but it is rather overloaded with irrelevant details. We hear far more about Cushing's neckties or menu's than about those of his hypotheses that were not confirmed. I am inclined to think that outside of a narrow circle of personal friends and admirers, general interest would run in the opposite direction.

ERWIN H. ACKERKNECHT

MAIZE IN THE GREAT HERBALS. *Hand-bound, limited edition.*

By John J. Finan; foreword by Edgar Anderson. Chronica Botanica Co., Waltham, Mass.; Stechert-Hafner, New York; in cooperation with Missouri Botanical Garden. $3.00. xvi + Pp. 149–191; ill. 1950.

The history of maize has provided one of the most fascinating stories in the entire field of botany, and despite the great amount of work which has gone into its clarification, there still remain certain unsolved problems of origin and distribution. John J. Finan introduces yet more complexity into the story, for instead of one type of maize having been introduced into Europe by Columbus, there was apparently a second type of unknown origin. The herbals describe both types. The herbalists believed that the second type came by way of Asia, but since it bears a close resemblance to the flints of eastern North America, there is a suggestion that it may have been introduced earlier by the Norsemen. In tracing down the descriptions of maize through the various herbals, Finan has had to employ the detective methods of the botanist, the historian, and the linguist, and the results have been, as Edgar Anderson points out in the Foreword, an integrated and coherent story —and, it might be added, a fascinating story. Of more than minor interest is the acknowledgement given to the Pioneer Hibred Corn Co. of Des Moines. It is a rare thing in these days for a commercial concern to expend funds on a project which in no conceivable way can contribute to its future income.

C. P. SWANSON

A HISTORY OF EXPERIMENTAL PSYCHOLOGY. *Second Edition.*

By Edwin G. Boring. Appleton-Century-Crofts, New York. $6.00. xxii + 777 pp. 1950.

This is a greatly expanded and revised version of Boring's history first published in 1929. The book needs no introduction to psychologists because it is already a classic in the field. For non-psychologists, let me say only that this is *the* history of experimental psychology. It is meticulous, carefully-documented, and well written. It should be of great interest to readers who are curious about the history of science generally.

A. CHAPANIS

THE YOUNG NATURALIST

HI, MISTER ROBIN.

By Alvin Tresselt; pictures by Roger Duvoisin Lothrop, Lee & Shepard Co., New York. $2.00. 25 pp., ill. 1950.

A simple story for small children of a boy who discovers the signs of approaching spring as he impatiently waits for winter to end.

The story seems too simple even from a child's point of view to be of interest to biology teachers, and the illustrations are only fair.

JOHN CUSHING

FIELD BOOK OF NATURE ACTIVITIES.

By William Hillcourt; illustrations by Francis J. Rigney. G. P. Putnam's Sons, New York. $3.95. 320 pp.; ill. 1950.

In this new member of the Putnam's Field Books series, a good cross-section is made through hobby fields in outdoor nature study. Part 1, activities in the Whole Field of Nature, discusses the possible choices in the biological field, and various modes of getting others interested in the same type of endeavor. Part 2, Specific Activities Projects, deals with ornithology, mammalogy (as the study of "animals"), herpetology, entomology, then a composite section on water life, and two approaches to botany: flowers and flowerless plants, and trees. In each section a great variety of practical hints is included, as well as references to important books, sources of equipment and materials, and the like. The

variety of "things to do" in each portion of the book will no doubt far exceed the probable scope of any one or even several youngsters, but every attempt is made to show the paths and fire them with enthusiasm. The *Field Book* will be highly useful also to camp counselors Scout leaders, and parents of children inquisitive about nature.

LORUS J. and MARGERY J. MILNE

THE NATURE DICTIONARY. *A Picture Guide to Living Things.*

By John Hayes Melady; illustrated by Samuel Nisenson; introduction by Marvin M. Brooks. World Publishing Co., Cleveland and New York. $2.00. 120 pp., ill. 1950.

In this large-sized volume, the plants and animals of the world, alphabetically arranged, are illustrated in full color and described in simple language for young people. The illustrations are not of the best, but are generally adequate, while the descriptions are sufficient for the audience intended. Over 400 species of plants and animals from all continents and seas are included, giving a fair representation of the higher forms of both kingdoms. The invertebrates and lower plants are for the most part omitted.

C. P. SWANSON

THE CHEWING GUM TREES.

By Ruth Bishop Juline; illustrated by Harlyn Dickinson. Lothrop, Lee & Shepard Co., New York. $2.50. 122 pp.; ill. 1950.

The Chicleros are the Indian peons of Yucatan who go into the forests to collect chicle. One of them, Pedro, takes his two children with him on one of his 9-months trips to initiate them into the mysteries of chicle hunting and of the jungle itself. This is their story: the trip through the dense growth and up the mountains, the collecting of the gum, the camp life, and the thoughts and everyday tasks and play of the Indian family. Well-written and illustrated, it is one of the better books for children.

C. P. SWANSON

COTTON. *Third Edition.*

By Floyd Barnhart. Published by the Author, Caruthersville, Missouri. $3.75. viii + 366 pp.; ill. 1950.

This book on the agronomics of cotton is designed for the use of secondary school students residing in the Cotton Belt of the United States. Topics covered are: the economics of the crop, harvesting, ginning, soils, and cultural practices.

STATE BIRDS AND FLOWERS.

By Olive L. Earle. Wm. Morrow & Co., New York. $2.00. 64 pp.; ill. 1951.

This is a very attractive little book. Beside an outline map of each state, showing only its capital city, is a competent and non-technical description of the state bird and flower. These are illustrated in the ample margins of each page by figures of high scientific accuracy and artistic merit. The book should make an ideal gift for state politicians to give their children.

GAIRDNER B. MOMENT

COLLECTING BUTTERFLIES AND MOTHS.

By Ian Harman. Williams & Norgate, London. 7s. 6d. 128 pp. + 7 pl.; text ill. 1950.

The embryo biologist usually receives his initial impetus to go into science from observations made of his surroundings, and this, combined with the hoarding habit, one of man's more obvious instincts, leads to an early development of collecting activities. The prettier the object the better, and it is probably for this reason that the moths and butterflies have come in for more than their share of attention. Recognizing this, the author has provided a set of instructions which should enable the collector to go about his hobby in a systematic and scientific manner. Equipment, trapping, rearing, and care of the collection are adequately discussed, as are the varieties which the English collector is likely to meet at various times of the year. The book is by no means written for the younger biologist only, but it will provide him with the necessary stimulus to continue him past the beginning stage into that of serious study.

C. P. SWANSON

OUR OUTDOOR NEIGHBORS. *Midwest Edition.*

By V. H. Culp. Burgess Publishing Co., Minneapolis. $1.75 (paper). iii + 129 pp. 1950.

The purpose of this study book is a worthwhile one, namely, to introduce and interpret nature for school children. The introduction states that this is a sort of trial balloon. With all due respect to the intentions of the writer, it is necessary to prick that balloon and hope that a more carefully constructed one will take its place. The reasons for not thinking that this first trial is successful are based on three considerations: a) inaccurate, misleading, and mistaken information; b) repetitious, inadequate, and confusing presentation of the subject matter; c) careless makeup, poor proofreading, and ambiguous grammar. To choose a sentence from the first category: "Flies carry the germs of such diseases as typhoid fever, tuberculosis, gangrene, and 'summer complaint.'" One including the first and third

categories: "The turle [sic] lived on the earth many thousands of years and one of our strangest reptiles. This reptile is a near relative of the snake for its head looks very much like that of the snake." Without belaboring the point, not only do such statements abound, but "shirkes," "artic terns," "provers," "cadice flies," and others lurk throughout. Classification is fortunately omitted, although the family concept is often misused. The contents include chapters on 1) insects, spinners, and earthworms; 2) fishes; 3) amphibians and crayfish; 4) snakes, lizards, and turtles; 5) birds; 6) mammals; 7) trees.

HENRI C. SEIBERT

FROGS AND TOADS.

By Herbert S. Zim; illustrated by Joy Buba. William Morrow & Co., New York. $2.00. 64 pp.; ill. 1950.

This is another of H. S. Zim's excellent nature books for children. The various species of frogs and toads are described, together with their life cycles and habits. The text and illustrations nicely complement each other.

REPTILES. *Their Habits and Care.*

By John F. Breen. All-Pets Magazine, Fond du Lac, Wisconsin. $1.85 (paper). 115 pp.; ill. 1949.

This is a pleasantly written little book that should have a very considerable appeal for the large number of amateur reptile fanciers. This small army may find here interesting discussions about the capture and captivity of many popular species of native turtles, lizards, snakes, and alligators. The style is rather reminescent of the tremendously stimulating, satisfactory, and successful Ditmars reptile books. The content, where it touches on the philosophies of science, conservation, and education, is largely in accord with advanced current thinking in these areas. Illustrations are numerous and many are new.

Recommendation is withheld, therefore, with considerable reluctance. This is done not primarily because of the fairly large number of errors of fact but because of a serious error of judgment. Speaking of our poisonous lizard, the Gila Monster, Breen states, "Vicious, newly-caught specimens soon become very tame and permit themselves to be freely handled without show of hostility." Although a Gila Monster in a shaded cage may be a docile captive, it is, nevertheless, a very dangerously poisonous animal and should always be treated with utmost respect. It would therefore seem to me that a person giving inexperienced amateurs—mostly young boys and girls—license to handle Gila Monsters freely is being criminally negligent.

Serious students of reptilian distribution will be disturbed by the suggestion that "... any reptile which persistently refuses to feed had best be released ...' in the vicinity of the owner's home, regardless of the provenance of the reptile. Breen suggests that lizards are somewhat less tolerant of cold weather than snakes and that reptiles continue to grow throughout life. These are interesting ideas that require qualification and, more important, confirmation. Breen states that a dead chameleon (i.e., *Anolis carolinensis*) is always brown. Every dead chameleon I have seen, prior to preservation, was green. He says that the pupil of a snake's eye is horizontally elliptical. As a matter of fact, in some snakes the pupil is vertically elliptical but in most species it is round. He also states that DeKay's Snake never exceeds a foot in length, although 18-inch specimens have been mentioned in the literature.

The Black Snake (*Coluber constrictor*) is said to be the largest serpent to be found over a considerable portion of its range. In the northeastern part of the range of the Black Snake, the Pilot Black Snake is larger; in the southeastern part, the Indigo Snake is larger; and in the western part, the Bull Snake is larger. Breen states that in favorable terrain, a Black Snake can outrun a man. In a thicket of tangled vines, such a result could be anticipated, but the reverse would certainly be true if the contest were held on an open lawn. The Scarlet Snake is said to be confined to the southeastern portion of the United States, whereas it is known from as far north as Indiana and New Jersey and as far west as Oklahoma.

Breen gives credence to the indicated age of a turtle as deduced by a date carved on its shell without apparently considering the possibility that the carving on the shell is not necessarily the date at which the carving was done. Breen apparently considers Box Turtles to be Old Guard Republicans: "Box Turtles are highly intelligent and, like most intellectually endowed humans, are rugged individualists." There are other anthropromorphic gems and there are illustrations unrelated to the text.

I do not think this book should be placed in the hands of impressionable youngsters.

ARNOLD B. GROBMAN

THE FIRST BOOK OF CATS.

By Gladys Taber; illustrated by Bob Kuhn. Franklin Watts, New York. $1.50. 41 pp.; ill. 1950.

For one who likes cats, and what child does not, Gladys Taber has provided a good first reader. The growth and development of cats, their habits, their likes and dislikes are described in sprightly words and pictures.

CATS.

By Wilfrid S. Bronson; illustrated by the author. Harcourt, Brace & Co., New York. $2.09. 76 pp.; ill. 1950.

This is an informative, ably written, and humorously illustrated book for children. It discusses cats of every description, from the alley cat to the pampered Persian. It also takes the reader through the daily life of a cat, showing how its activities are related to its anatomical features. The book ends with a brief description of the major members of the cat family.

THE WAHOO BOBCAT.

By Joseph Wharton Lippincott. J. B. Lippincott Co., Philadelphia and New York. $2.50. 207 pp. + 5 pl.; text ill. 1950.

The Wahoo Swamp lies in the Florida wilds, and there this bobcat ruled supreme. In telling his story of the bobcat's friendship with a backwoods boy, Joseph W. Lippincott gives an excellent portrayal of the swamp lands, their wildlife inhabitants, and the forces of nature which come into play to make the lives of the animals and the existence of man precarious and tenuous indeed.

ADVENTURES IN CACTUS LAND.

By Betty Boulton Herndon. The Caxton Printers, Caldwell, Idaho. $3.00. 169 pp.; pen drawings by the author; frontispiece. 1950.

This book, written for children about desert animals, definitely does not compare favorably with *The Wind in the Willows*, as its jacket maintains. In fact, there is nothing to be said in its favor. The illustrations are not particularly good, and the stories of Ronnie Road Runner, Honey Hummingbird, etc., are written in such a saccharine style as to destroy any attempt at adult participation in whatever emotions (other than horror) these stories might arouse in a child.

JOHN CUSHING

EFFECTIVE LIVING. *Third Edition.*

By C. E. Turner and Elizabeth McHose. Prentice-Hall, New York, Chicago, and San Francisco. $2.40. viii + 452 pp.; ill. 1950.

A standard high school textbook for human physiology and hygiene. Its three parts deal respectively with the health problems of the individual, the family, and the community. There is an appendix or index about specific communicable diseases and another listing references and source materials.

INDIANS OF THE LONGHOUSE. *The Story of the Iroquois.*

By Sonia Bleeker; illustrated by Althea Karr. William Morrow & Co., New York. $2.00. 160 pp.; ill. 1950.

Told in simple form, this is a descriptive tale of the life of the Iroquois who inhabited what is now the State of New York. Their warring activities are minimized, greater emphasis being placed upon their farming and home practices as they varied during the seasons of the year. Anyone who can read will enjoy this book, which concludes with a chapter on the Iroquois of today. Many pencil sketches are used to illustrate the text.

ECOLOGY AND NATURAL HISTORY

A CUP OF SKY.

By Donald Culross Peattie and Noel Peattie; illustrations by Lynd Ward. Houghton Mifflin Co., Boston. $2.50. 242 pp.; ill. 1950.

Noel Peattie joins his famous father for the first time in writing about the curiosities of nature. The book opens with the story of Saint Francis of Assisi and his Hymn to Creation. He gives thanks to the wind, weather, fire, water, moon and stars, and the chapters that follow deal with these matters of earth and the heavens. Father and son start off together discussing the sunlight with its "boundless power" and the warm hand it keeps upon us. Then each separates, father Peattie pointing the beauties of earth, while son Peattie expresses his thoughts on the heavens. Noel Peattie writes chapters on Shooting Stars, The Evening Planet, The Moon and Our Heavenly Earth. He shows his keen interest in astronomy as well as his talents in writing when he calls the moon that "high-held and kindly lantern" and refers to the evening star as seeing "men on the edge of night walking home from the city—."

However, the major part of the book is by Donald Culross Peattie, with his usual admirable style and observations. In talking about honey he reminds us that "a drop upon the tongue is to partake of a sacrament with nature." Both father and son display the family talents. The book is light reading, yet thought-provoking, and the illustrations by Lynd Ward at the beginning of each chapter are extremely well done. There is no index.

LORUS J. & MARGERY J. MILNE

SOIL CONDITIONS AND PLANT GROWTH. *Eighth Edition.*

By Sir E. John Russell; eighth edition recast and rewritten by E. Walter Russell. Longmans, Green

& Co., New York, Toronto, and London. $6.50. xvi + 635 pp. + 38 pl. 1950.

This well-known book, now in its 8th edition, has been completely revised and brought up to date by its new author. The content, as well as the general outlook, remains essentially the same. The major emphasis throughout the book is on the nature of the soil, and its function as a substrate in which plants grow. This is not to minimize the extensive considerations which are given to soil microorganisms and their importance in soil-plant relationships.

The changes which the new author has introduced are very commendable, and one is particularly impressed with his consideration of soil structure, as well as the role played by soil organisms, in maintaining the necessary balance. The examples which are cited in the book are drawn from many different sources throughout the world, and the book is even more useful in this respect, since the original references are given in some detail. There are numerous illustrations and halftones which are excellently reproduced. A subject, as well as author, index is included.

W. D. McElroy

Watch Out for the Weather.

By Jacqueline Berke and Vivian Wilson; drawings by Lombard C. Jones. Viking Press, New York. $2.95. x + 226 pp.; ill. 1951.

A slickly written, highly "popularized" presentation of the speculative school of climatologists, which could be excellent satire, but was probably written seriously. It is of no value to scientists except perhaps as an example of what they have to contend with when they seek to instruct the general public.

Douglas H. K. Lee

Natural Regions of the U.S.S.R.

By L. S. Berg; translated from the Russian by Olga Adler Titelbaum; edited by John A. Morrison and C. C. Nikiforoff. The Macmillan Co., New York. $10.00. xxxii + 436 pp. + 36 pl.; ill. 1950.

For the American reader of Soviet geographical and biological literature, Berg's *Natural Regions of the U.S.S.R.* is of real value. The author's intimacy with the area's physical (as contrasted with cultural) features and his extraordinary breadth of interests and achievements give this book a strong authoritative quality which is a distinct relief after the piles of printed, speculative, hopeful or derogatory writings on Soviet economics, politics, or civilization. Berg's book is simple in style, factual and direct, and strictly to the point: he deals with *natural regions*.

There is barely one page of introduction in which Berg explains that the Soviet Union is too large to be treated as a unit and then lists the regions into which he divides it. The rest of the book is devoted to the individual regions. One might fear, at first, that this procedure would break the continuity of the book, that one would be confronted with a set of individual physical geographies. This is far from true. As one reads on, one comes across frequent references to earlier sections, so that in fact, and in spite of regional segregation, there slowly but surely unrolls before one's eyes a picture of the entire Soviet Union.

The book has 20 chapters, each of which is devoted to one region. The treatment of these is not entirely uniform, but a broad pattern is repeated throughout the book. This pattern consists of the sequence of relief, climate, soil, vegetation, and fauna. The stress varies considerably from one chapter to the next except that nearly always much space is devoted to vegetation and fauna.

Biologists, especially those interested in biogeography, will soon discover that this book is a treasure. For Berg, in spite of his many interests, is at heart a biologist, and his book gives eloquent testimony to this. Nearly one-half of the entire space is devoted to descriptions of the vegetation and the fauna of the 20 regions and to the geographic distribution of species. In fact, one is almost inclined to say that here is a book on the biogeography of the Soviet Union, with rather elaborate descriptions of the topography, climate, and soil of the various habitats. The book certainly was not meant to be such, but biogeographers will find here more information on their subject than in any other book in English on the physical geography of the U.S.S.R. This is not to say, however, that the other aspects have been slighted. Climate and soil are indeed, at times, treated somewhat skimpily, but the lack of information on the relevant details, even inside the Soviet Union, is only slowly overcome.

One might have hoped for more and better illustrative material, both photographs and maps, since the ones supplied do no more than hint at what the text describes. Separate indices for plants and for animals and a Russian transliteration table add materially to the value of this important book.

A. W. Küchler

Marine Geology.

By Ph. H. Kuenen. John Wiley & Sons, New York; Chapman & Hall, London. $7.50. x + 568 pp. + 3 folding charts; text ill. 1950.

The appearance of a second treatise in English so soon after Shepard's *Submarine Geology* (1948) inevitably invites comparison with that work. However, as Kuenen observes, there is very little duplication in the two volumes. His own treatise is especially strong on coral reefs and aspects of the marine geology of the East Indies. Indeed, it has been suggested that the title

should be qualified by some such phrase as "With special reference to the Dutch East Indies." As in Shepard's book, the problems of shorelines are treated briefly, and historical geology and paleontology remain virtually untouched. Treatments of some of these subjects are available elsewhere, and admittedly the line has to be drawn somewhere if such a treatise is to be kept within the confines of a single volume of easily handled dimensions. It is for the 65-page chapter on coral reefs that biologists will consult this book. It is a self-contained treatment, illustrated with 36 text figures, and comprises a major contribution to the literature upon coral reefs. In brief, the author proposes a modification of the glacial control theory. In his view a major part is played by chemical erosion of reef substances by sea water during rises of the sea level. This is a theory which has the virtue of permitting a continuously favorable environment for corals throughout the Pleistocene within the areas now occupied by living reefs.

Of the subjects untouched in Shepard's book but treated here, that on sedimentation is the most detailed, and the section on turbidity currents presents material on which Kuenen is an acknowledged authority. An interesting diagram of the marine environment (p. 314) will probably find its way into biology textbooks.

JOEL W. HEDGPETH

A GEOGRAPHIC STUDY OF THE HERPETOFAUNA OF ALTA VERAPAZ, GUATEMALA. *Contrib. Lab. Vert. Biol., Univ. Mich., No. 45.*

By L. C. Stuart. University of Michigan Press, Ann Arbor. $1.50 (paper). 77 pp. + 9 pl. + 1 folding map. 1950.

This paper is essentially the second half of an account of the zoogeography of Alta Verapaz, Guatemala, based upon the amphibians and reptiles of the area. A systematic consideration of the animals formed the first half of the study (*Q.R.B.*, 24: 58. 1949).

The present paper is a fairly detailed discussion of the static aspects of animal distribution, beginning with the geology, physiography, climate, and vegetation of the Department. Stuart then evaluates the factors affecting the present faunal arrangement and suggests life areas, which he maps both spatially and vertically. There follows a dynamic account of the zoogeographic history in which continental connections and separations (both to the north and south), mountain raisings during the Pliocene, and colder climates during the Pleistocene, are considered to be active agents in determining the nature of the present herpetofauna. The paper is illustrated with some photographs of the countryside.

ARNOLD B. GROBMAN

LIFE HISTORIES OF NORTH AMERICAN WAGTAILS, SHRIKES, VIREOS, AND THEIR ALLIES. *Order Passeriformes. Smithsonian Inst., U. S. natl. Mus., Bull. 197.*

By Arthur Cleveland Bent. Smithsonian Institution, Washington, D. C. $1.50 (paper). viii + 411 pp. + 48 pl. 1950.

This is the 18th number in this well known series of life histories of North American birds. The allies referred to in the title include such forms as the accentor, pipits, waxwings, the phainopepla, starling, and Bahama honeycreeper. All species and their geographical forms are treated as in previous numbers. The price of these government bulletins still remains low, but they apparently enjoy such a wide popularity that they are soon out of stock and each year seem to become scarcer within a shorter time. In no time at all "second-hand" book dealers come out with new, uncut copies at $5 and up. "There oughta be a law."

HENRI C. SEIBERT

BRITAIN'S BEASTS OF PREY.

By W. Kay Robinson; illustrated by Raymond Sheppard. Latimer House, London. 7s. 6d. 128 pp.; ill. 1949.

It is always a great pleasure to read an article or a book that is sympathetic in its treatment of beasts of prey. In Europe, generally, predators are considered vermin —and that's that. Therefore it is encouraging to report that progress is being made with regard to changing this traditional attitude in Great Britain and that some effort is being expended to protect some of the surviving remnants. But this is not a book on conservation—it is simply a readable account of experiences with the predators: the wolf, wild cat, polecat, weasel, fox, otter, and badger. Since the wolf is gone and the wild cat remains only in a few remote areas, the majority of these stories concerns the others. They include some highly interesting observations or tales reported by other observers. The scientific mammalogist will be skeptical about some of these reports, or irritated at the lack of substantiating evidence, but if the general purpose of the book is kept in mind, and if the good that it will do when read by the public is appreciated, then its few faults are far outweighed by its entertainingly written effort to attain a meritorious objective.

HENRI C. SEIBERT

THE MAMMALS OF WATERTON LAKES NATIONAL PARK. *Wildlife Management Bull., Ser. 1, No. 1.*

By A. W. F. Banfield. Department of Resources and Development, Development Services Branch, Canadian Wildlife Service, Ottawa. Free upon request (paper). 43 pp. + 11 maps. April, 1950.

A Study of Bird Populations in the Apple Orchards of the Annapolis Valley, Nova Scotia, *with Particular Reference to the Effects of Orchard Sprays upon Them. Wildlife Management Bull., Ser. II, No. 1.*

By John P. Kelsall. Department of Resources and Development, Development Services Branch, Canadian Wildlife Service, Ottawa. Paper. iii + 69 pp.; ill. April, 1950.

Prince Albert National Park—*Creel Census Analysis, Season 1948. Wildlife Management Bull., Ser. III, No. 1.*

By Victor E. F. Solman. Department of Resources and Development, Development Services Branch, Canadian Wildlife Service, Ottawa. Paper. ii + 29 pp.; ill. May, 1950.

Series I concerns the mammals of Waterton Lake National Park, in the southwest corner of Alberta, Canada. This bulletin consists of three parts: the ranges and populations of the larger mammals; the natural ranges within the Park and the effect of grazing by domestic stock; an annotated list of all mammals known to occur within the Park. The first part gives some interesting data on the distribution and dispersal of the large game mammals and maps to indicate their summer and winter ranges. The second study is discussed so very briefly that its significance is open to question. In the annotated list, information is provided also on the distribution of the smaller mammals.

Series II is a good study on bird populations within commercial apple orchards in Nova Scotia. It was found that bird densities averaged 1 per acre, this low value being attributed primarily to a lack of suitable food. Where aphids or budworm were prevalent the density increased. No effect of insecticidal sprays on the birds could be detected.

Series III interprets the results of creel censuses from a group of lakes in the Prince Albert National Park. The species analyzed were mostly pike and pikeperch. Each of the 6 lakes is considered individually, and wherever the data warrant it certain fishing recommendations are made.

Henri C. Seibert

University of Colorado Studies. *Series in Biology, No. 1.*

Editor: Karl K. Hulley. University of Colorado Press, Boulder. $1.00 (paper). 50 pp. + 6 pl.; text ill. June, 1950.

This number is the start of a separate series in biology. The issue contains the following papers: *Kalanchoe tubiflora* as Influenced by Radiation (Edna L. Johnson and Dorothy B. Kingsbury); A Limnological Reconnaissance of Grand Mesa, Colorado (Robert W. Pennak); *Physaria vitulifera*, a Tetraploid Species of Cruciferae (William A. Weber and James L. Brewbaker); The Production of Sound in Caudate Amphibia (T. Paul Maslin); and Recent Additions to the Flora of Colorado (William A. Weber).

Outline for a Classification of Animal Habitats in Honduras. *Bull. Amer. Mus. Nat. Hist., Vol. 94, Art. 10.*

By Archie F. Carr, Jr. American Museum of Natural History, New York. $1.25 (paper). Pp. 563–594 + 22 plates; text ill. 1950.

The Life History of the Starry Flounder, *Platichthys stellatus (Pallas). Fish Bull. No. 78.*

By Harold George Orcutt. Bureau of Marine Fisheries, State of California, Department of Natural Resources, Division of Fish and Game, San Pedro, Cal. Free upon request (paper). 64 pp.; ill. 1950.

Annales Biologiques. *Volume VI.*

Edited by H. Blegvad, with AA. J. C. Jensen. Conseil Permanent International pour l'Exploration de la Mer, Charlottenlund, Denmark. Kr. 25.00 (paper). 192 pp.; ill. December, 1950.

EVOLUTION

Evolution Emerging. *A Survey of Changing Patterns from Primeval Life to Man. A Collaborative Work of The American Museum of Natural History and Columbia University. Two Volumes.*

By William K. Gregory. Macmillan Co., New York $20.00. Vol. I: xxvi + 736 pp.; Vol. II (illustrations): 1013 pp. + 3 folding plates. 1951.

These two magnificant volumes, Gregory's magnum opus, are the result of a remarkable and wonderful combination of unique ability and fortunate circumstance. Gregory has developed his towering stature in paleontological-morphological-philosophical studies during a period, beginning more than 50 years ago, wherein old notions about evolution have given way to new ideas and vertebrate paleontology has grown from a minor bud in the vicinity of taxonomy and morphology to a vast and intricate branch of knowledge.

The title page generously states that this is a collaborative work of The American Museum of Natural History, where Gregory helped accumulate the largest collection of recent and fossil vertebrates, and Columbia University, where he learned from the great teachers to whose memory the book is dedicated.

Many students of anatomy and paleontology have known for years that this work was in preparation and have eagerly waited for its issue. (It was even reviewed in galley by H. W. Rand in *Science* 113: 434–438. 1951.) It amply fulfils expectations of magnitude and competence, and it is unexpectedly different from many of Gregory's own previous publications and from those of his students, for whom he served as fountainhead for works in vertebrate paleontology. He demonstrates anew that

he has not only kept abreast of most of the advances on an enormous front, but that as a self-styled "educational hybrid between Science and Philosophy" he can push beyond the vanguard into such realms of inquiry as the details of hearing mechanisms in certain fish and opinions about some of the causes of wickedness among men.

In this gigantic and carefully designed compendium, one volume of text and one of figures, Gregory projects the "Cosmic Cinema" from the origin of the earth to the development of our ability to build air castles. Mostly, however, he presents his scholarly view of the colossal kaleidoscope of vertebrate form and phylogeny or of "terrestrial organic evolution." As such it will become a bible in vertebrate paleontology and comparative anatomy, a classic to be studied and quoted and interpreted—the provident source, for students and scholars, of thousands of illustrations, lantern slides, quotations, lectures, and new ideas for research. When and if the prime secrets of evolution and of mind are revealed, this massive document will retain great value as a record of knowledge and of an inspired man.

Here is the good teacher, forceful and relaxed, at his job. He carefully selects the apt and telling phrase, he cites personal experience and attitude, he compares and summarizes, he digresses readily, he recognizes and copiously uses analogy, he changes pace, he speaks at various levels, and he keeps the whole finished form in view while manipulating an incredible number of fragments. He doesn't hesitate to jump from the stark statement of a datum to the whimsical and humorous quip. He praises good work, he marvels at nature, and he scolds the public, popular journalism, contemporary education, splitters, careless taxonomists, and the proponents of certain scientific dogmas. As a result, the dead bones of fossils do more than live again in this book—they instruct and encourage.

Volume I (in handsome two-column format) is divided into 6 parts. The first begins with an explanation of the book's theme and discusses the origin of life, the molluscs, and the arthropods. Part Two ranges from chapters on the origin of vertebrates through a very long section on bony fish. Parts Three and Four are devoted to air-breathing vertebrates, from the Choanata through the rise and branching of mammals. Part Five, on primates, is entitled The Devious Paths to Man; and the concluding part is Evolution Emerging: Retrospect and Prospect. Hundreds of subtitles are interspersed in the text, some with such light and interesting touches as The Bivalves, Brainless but Successful; The Tarpon: A Study in Skeletal Engineering; A Motley Crew; A Strange Collection of Evildoers; High-Powered Aardvarks; and A 'Vulgar Error' About Whales.

The bibliography of 144 pages is arranged under the same headings as the text and contains well over 5000 separate titles, even allowing for some repetition. An author index of several hundred names precedes the generous and excellent general index of five or six thousand entries.

Volume II, Illustrations, contains, according to Gregory's system of numbering, 1023 figures, a few of which are duplicates. Most figures are composed of several line drawings—as many as several dozen—arranged in "comparative systematic lines." Some of the outlines are crude and sketchy and the few half-tone plates are not well reproduced, but in general the cuts are clear and have good labels either accompanying them or in the text. It is extremely regrettable, however, that most of the figures do not indicate the actual sizes of the objects they represent, particularly because the scales are mixed on many figures. This lack of indication of size is the most serious deficiency in the whole work, in view of the uses to which it will be put.

Some figures are merely indicated by the text, which would be several times as long if each picture were described; and some sections of the text, such as the comparatively brief one on the rise and branching of the mammals, are far more richly illustrated than others. Text and figures together present many original and useful charts and diagrams and lists and tables of anatomical and functional comparisons.

Specialists will regret that, for all its magnitude, each section of this work is not longer and more exhaustive. Because of its vast size and comprehensiveness it will elicit a wide range of reactions and will provide ample material for diversified criticism. There will be debates and disagreements about Gregory's treatment of natural selection, the origin of species, preadaptation, Dollo's "law," stratigraphic terms, the degree to which evolution is reversible, Design vs. Chance, and many other items and ideas.

Some students will carp that the continual Gregorian chant of polyisomerism and anisomerism and polyanisomerism is too obtrusive and that they are being hit on the head with habitus and heritage; others will bewail the virtual omission of such old favorites as orthogenesis. Purists will see foggy thinking in Gregory's treatment of individuals as representatives of genera rather than of species which, in turn, compose genera. Many scholars will rejoice that he is not beguiled and misled by some of the current preachments in taxonomy which, although based upon acceptable genetic concepts, give only lip service to morphology and paleontology. Everyone who uses these books will be pleased that so few of the common book-making slips and errors have crept in.

Many studies and many disciplines will be enriched by this work. As the author says, his field "has gradually been pieced together, like a vast picture puzzle, by the patient labors of hundreds of investigators . . .

"But who can tell the span or know the limits
In Time's equation of the Past and Future?
What! will the players quit, with coin in hand,
Tipping the cosmic table in their anger?

'Tis idle to imagine; they'll stay in,
'Law' against 'Chance,' so spin the wheel again!"

GLENN L. JEPSEN

FACTORS OF EVOLUTION. *The Theory of Stabilizing Selection.*

By I. I. Schmalhausen; translated by Isadore Dordick; edited by Theodosius Dobzhansky. The Blakiston Co., Philadelphia and Toronto. $6.00. xiv + 327 pp.; ill. 1949.

Schmalhausen, as Th. Dobzhansky says in a Foreword to this book, is—one should perhaps more truthfully say *was*—one of "the most distinguished among the living biologists in USSR," a man trained under Severtsov in comparative anatomy and vertebrate evolution, and himself leader of a great school of experimental morphologists and embryologists. His lifelong interest in evolution culminated in this book, published in Russian in 1947, in the same year as the great book by Rensch that deals with similar problems (see *Q.R.B.*, 24: 233. 1949).

In a fine review of the present book that renders others almost superfluous (*J. Hered.*, 40: 322. 1949), G. G. Simpson has traced the origin of Schmalhausen's central evolutionary concept, that of "stabilizing selection," back to the evolutionary "factor" emphasized by J. M. Baldwin in 1902, namely, the concept that modifications induced repeatedly in individuals of a given species by the environment will eventually be replaced by hereditary changes that bring about the same alteration of the phenotype. This is clearly evident from the frequency with which mutants are parallelled by phenocopies, as Goldschmidt has emphasized. But Schmalhausen's concept of "stabilizing selection" goes much farther than this and is related mainly to the evolutionary production of regulating mechanisms and to the elimination by selection of disharmonies, so as to preserve the ontogenetic norm. These are concepts which have been discussed clearly and illustrated fully by Goldschmidt in *The Material Basis of Evolution* (1940). Schmalhausen's approach to the subject of evolution is thus one which, it is obvious, would inevitably lead to the clash with Lysenko that actually occurred in 1949 and that brought about the fall from grace of Professor Schmalhausen. For Schmalhausen's standpoint, in spite of his repudiation of neo-Darwinism, is fundamentally the genetic and neo-Darwinian approach to the understanding of embryological and morphological problems.

The first of the 4 extended chapters into which the book is divided is devoted to a thorough consideration of the nature of individual variability, its genetic basis, and the role of internal and external factors in modifying the "norm of reactions." In discussions that show an excellent grasp of genetic concepts and a broad knowledge of the data of genetics, Schmalhausen develops and emphasizes his primary ontogenetic concept, that of cell and organism as systems of dynamic but *stable* equilibrium wherein the genes establish the *norm of reaction* toward a given environment. Variations in the environment produce modifications in ontogenesis, but variations in the norm of reaction "provide a foundation not only for the development of species and racial differences but also for the appearance of seasonal or ecologic polymorphism" (p. 37). Thus the reaction norm and the deviations from it are of crucial importance in natural selection. These concepts trace back to Woltereck (1919) and have also been very fully considered by Goldschmidt (loc. cit).

In Chapter 2, on the Dynamics of the Historic Variability of Populations, Schmalhausen develops the distinction between dynamic and stabilizing selection. Whereas the former has been commonly regarded as the essential character of natural selection, Schmalhausen emphasizes the great significance of stabilizing selection, which is "based upon the selective advantage under definite and, especially, fluctuating conditions possessed by the normal organization over variations from the norm" (p. 73). The result is the elimination of most variations and "the establishment of more stable mechanisms of normal morphogenesis." This concept is fully in accord with the general recognition by geneticists of the detrimental character of the great majority of mutations. It is analogous to Sewall Wright's picture of the narrowing of the variation in a population around an "adaptive peak" whenever the rigor of selection is increased. But it goes farther than these related concepts in its application to individual morphogenesis, which becomes, as it were, buffered against change by a regulating apparatus that includes not only physiological mechanisms of a homeostatic nature but also genetic buffers (dominance and other modifiers, suppressor genes, etc.). The development and illustrations of these ideas provide a valuable part of the book, reenforcing and somewhat extending Goldschmidt's treatment of the topic.

In the third chapter, or section, of the book there is definition and illustration of various types of evolutionary change: (1) *aromorphosis*, the transition to a more complex type, that is, a progressive change to a higher level of organization by means of new generalized adaptations that permit the conquest of new ecological niches; (2) *allomorphosis*, adaptive responses to altered environment that leave the organism at the same limited level of adaptation; (3) *telomorphosis*, restrictive specializations, adaptive but narrow; and (4) *katamorphosis*, regressive changes that simplify the organism's relations to its environment. There is not much new in this but the terminology. The same concepts have been treated by Simpson, and especially

by Rensch, in other language. But the relation of these types of evolution to adaptive modification and the adaptive norm in discussions of the developmental effects of mutations is comprehensive and masterly. Stabilizing selection is again seen at work in "the elimination of mistaken, premature, or belated responses to accidental and transitory variations in the external environment . . . [which] leads to . . . individuals with a more stable morphogenesis, a limited tissue reactivity, and internal regulating mechanisms which counteract the harmful influences of the external environment" (p. 243).

Chapter 4, on the Rate of Evolution and Factors Determining It, is suggestive but relatively brief. The conclusions need much more extensive documentation to be soundly developed or convincing. There are numerous signs, too, that the author is out of his element, not merely in the application of this types of evolution to paleontological trends, but in error of fact as well as interpretation. One of the most astonishing remarks is that "beginning with the Jurassic [and the advent of birds] the insects (and spiders) then degenerated . . . ," the idea apparently being that adaptations for defense against powerful predators not only rule out progressive evolutionary changes but tend toward katamorphosis.

The book is not easy reading. The author often speaks for page after page ex cathedra, and a reader who is unable to supply the wealth of example and documentation needed may quite erroneously leap to the conclusion that the work is dogmatic and unsound. What is true is that it lies, among books on evolution, at the opposite pole from Julian Huxley's *Evolution: the Modern Synthesis*, with the latter's superabundance of cited evidence. Here in Schmalhausen's book, partly because of the sparseness of examples, the style is compact, heavy—too, too solid. Maybe this is in part chargeable to the translator, who shows some inexperience in rendering into English this type of material, e.g., "conservation" for "conservatism" and crayfish for "gammarids" (p. 249). But the translator cannot be held responsible for the general tenor of the writing, which all too frequently includes passages of magnificent obscurity, grandiose sentences that express the simplest biological platitudes, or demonstrations of circular reasoning, e.g., "The conclusion is inescapable that the high position of these organisms [birds and mammals] has facilitated their evolution."

Here, nonetheless, is a book every serious student of evolution will need to master. For the geneticist and the embryologist in particular, it contains much of insight and stimulating character. It is no textbook for the younger student, but an evolutionary dialectic for those who have already a wealth of the requisite facts.

BENTLEY GLASS

BALTIC AMBER SPIDERS IN THE MUSEUM OF COMPARATIVE ZOÖLOGY. *Bull. Mus. comp. Zool., Harvard Coll., Vol. 103, No. 5.*

By Alexander Petrunkevitch. Museum of Comparative Zoölogy, Harvard College, Cambridge, Mass. $3.25 (paper). Pp. 259–337 + 27 pl. 1950.

In his monographic paper of 1932, A Study of Amber Spiders (*Trans. Conn. Acad. Arts & Sci.*, 34: 119–464) Petrunkevitch concluded that the Baltic Amber spider fauna showed a distinct exotic affiliation, presumably with the tropics of the Old World, and was without any known living representative. In the present paper, which is a second supplement to the above and is concerned with the material found in the Museum of Comparative Zoölogy, additional evidence is brought forward to strengthen this general thesis. The spiders of the amber show only small relation to the present European fauna and differ from living spiders to a considerable extent in generic and to a much smaller extent in familial characters. Of the 20 families represented in the present collection, one (Dictynidae) is a recent family found for the first time in amber, and another (Ephalmatoridae) is described as new and seemingly extinct. Five new genera and 17 new species are described in detail. Thus, 6 of the 31 known families in amber are extinct, while of the 68 genera so far recognized by Petrunkevitch, 56 are extinct.

W. J. GERTSCH

THE PHYLOGENY OF TERMITE GENERA BASED ON IMAGO-WORKER MANDIBLES. *Bull. Amer. Mus. nat. Hist., Vol. 95, Art. 2.*

By Muzaffer Ahmad. American Museum of Natural History, New York. $.60 (paper). Pp. 37–86; ill. 1950.

The phylogeny of 139 out of a total of 142 genera and subgenera has been worked out on the basis of the conservative character, the imago-worker mandibles. Several instances of convergent evolution are reported to have occurred in the termites. A number of evolutionary and genetic concepts are considered.

SOME TERTIARY MAMMALS AND BIRDS FROM NORTH AMERICA. *Contrib. Paleontol., Carnegie Inst. Wash., Pub. 584.*

By Robert W. Wilson, Hildegarde Howard, Loye Miller, and Chester Stock. Carnegie Institution of Washington, Washington, D. C. $4.25 (cloth); $3.75 (paper). iv + 244 pp. + 19 pl.; text ill. 1949.

Five of the 8 papers in this report are by Wilson. All but one of the 5 describe additional rodent and lagomorph material from the Eocene of southern California,

the White River deposits of Colorado, and the Rincon deposits of Chihuahua, Mexico. New species are described and illustrated, previous forms redescribed, and certain relationships discussed. The fourth paper is a major contribution of great importance, being a discussion of the early Tertiary rodents of North America. It is argued that the fossil rodent record is not sufficiently well known to justify the conclusion that it represents the actual fauna then existent and is not influenced by biased collection of samples. On this apparently valid assumption, it is concluded that rodent evolution in North Aemrica started with the early Eocene differentiation of the Paramyinae into a sciuravine and a cylindrodontine branch. Evolution occurred at a rapid rate, at least during some periods of the Eocene, the aplodontoids increasing in number through the Duchesnean and then declining to be replaced by non-aplodontoid forms. The number of rodent groups increased progressively with time, and it is believed that the characters of the teeth, although difficult to study, are still the best criteria to determine phylogenetic patterns within these groups. Details and conclusions of great value and interest must necessarily be omitted here. The next 2 papers concern avian fossils. The first of these, by Howard, consists of new species described from the Pliocene of California. The second, by Miller and Howard, discusses in detail the fossil form *Mancalla*, now believed to be a type of flightless auk, with non-degenerative wings adapted for aquatic locomotion, and weak pelvic appendages unsuited for successful terrestrial locomotion. Two species are recognized. The appearance of *Mancalla* is compared to the development of the flightless penguins and the flightless great auk. The last paper, by Stock, describes new mammals, mostly perissodactyls and artiodactyls, from the Titus Canyon formation of California.

HENRI C. SEIBERT

ON THE ORIGIN OF SPECIES *by Means of Natural Selection, or The Preservation of Favoured Races in The Struggle for Life. A Reprint of the First Edition.*

By Charles Darwin; foreword by C. D. Darlington. Philosophical Library, New York (printed in Great Britain). $3.75. xxii + 426 pp. 1951.

ON THE ORIGIN OF SPECIES BY MEANS OF NATURAL SELECTION. *A Reprint of the Second Edition. The World's Classics.*

By Charles Darwin. Geoffrey Cumberlege, Oxford University Press, London, New York and Toronto. $1.10. lxiv + 454 pp. 1947.

According to the publishers, the Philosophical Library volume is the first reprint of Darwin's original edition, containing his ideas as first set forth, before yielding and indecision caused revision and the retraction of certain hypotheses. C. D. Darlington contributes a well-written and informative Foreword in which the circumstances of publication are set forth. The World's Classics volume is a reprint of the second edition, but its particular usefulness to the historian stems from an introductory section in which a page-by-page comparison of editions is given. The changes in Darwin's points of view can thereby be traced throughout the six editions of the book.

EARLY MAN IN THE NEW WORLD.

By Kenneth Macgowan. The Macmillan Co., New York. $5.00. xviii + 260 pp.; ill. 1950.

Early man in the New World is a difficult topic. The literature on the subject is large. It touches very many fields of knowledge. Views as to the racial, temporal, and cultural origins of "the" Indian are diverse and are defended by partisans in entrenched positions. Macgowan has the enormous advantage of being an outsider. He entered the field wearing none of the old school ties. As a playwright and producer he is literate. As an intelligent layman, he has presented a digest of this most interesting subject. Its merits lie in its simplicity, its freedom from the usual biases, and its refreshing, evenhanded criticism of the various views. He takes few stands but tends instead to present the contrasting views.

One will find here much more than just "Man in America." The extinction of Pleistocene animals, the causes of glaciations, a history of the growth of our knowledge of prehistory in the Old World as well as the New, the origins of New World high cultures (diffusion vs. independent invention) are some of the topics discussed. If the book has a fault, it is that it is too brief. Macgowan wrote for intelligent laymen rather than the specialists. The specialist will feel that his own field has been slighted, but the layman will find plenty of facts and theories. Would that we had more such intelligent amateurs! I wonder what a bright anthropologist might do if he invaded Broadway?

GEORGE F. CARTER

1940 E. W. SCRIPPS CRUISE TO THE GULF OF CALIFORNIA. *The Geological Society of America, Memoir 43. Part I. Geology of Islands and Neighboring Land Areas. Part II. Megascopic Paleontology and Marine Stratigraphy. Part III. Submarine Topography of the Gulf of California. Part IV. Report on the Pleistocene and Pliocene Foraminifera. Part V. Sedimentation and Oceanography: Survey of Field Observations.*

By Charles A. Anderson (I), J. Wyatt Durham (II), Francis P. Shepard (III), M. L. Natland (IV), and Roger Revelle (V). The Geological Society of America, Nw York. $6.50. vi pp. Part I: viii + 53 pp. + 3 pl.; text ill. Part II: viii + 216 pp. + 48 pl. + 2 tables. Part III: viii + 32 pp. + 3 pl.; text ill. Part IV: vi + 55 pp. + 12 pl. + 1 table.

Part V: 6 pp. Supplement: 11 folding charts. 1950. Three of the papers are concerned with paleontology and physical oceanography. These contributions provide material for the study of the present biogeography of the Gulf of California. The Memoir as a whole is a useful companion piece for Rickett's half of *Sea of Cortez*.

JOEL W. HEDGPETH

GEOLOGY OF THE COAST RANGES IMMEDIATELY NORTH OF THE SAN FRANCISCO BAY REGION, CALIFORNIA. *The Geological Society of America Memoir 35.*

By Charles E. Weaver. The Geological Society of America, New York. $6.50. x + 242 pp. + 5 pl. + 9 maps; text ill. 1949.

The area considered in this work is of particular interest to biologists because of the peculiarities of plant and animal distribution encountered there. The geological history sheds some light on problems of distribution, and makes this work an essential reference for their future study.

BIBLIOGRAPHY AND INDEX OF GEOLOGY EXCLUSIVE OF NORTH AMERICA. *Geol. Soc. of Amer., Vol. 14.*

By Marie Siegrist. Geological Society of America, New York. $3.00. xii + 375 pp. 1950.

Another volume of this model index by author, subject, geographical area, and geological time. It is indispensable not only to all geologists, but also to all paleontologists and students of evolution. When the other sciences in this country provide similar thorough indexes, much of the present confusion owing to the profuseness of scientific publication will wane. This would indeed be a task worthy of the fullest support of the National Science Foundation or some other.

GENETICS AND CYTOLOGY

HEREDITY. *East and West. Lysenko and World Science*

By Julian Huxley. Henry Schuman, New York. $3.00. x + 246 pp. + 1 pl. 1949.

Heredity East and West describes the liquidation of the science of genetics in Soviet Russia. The author discusses the twelve-year-old, losing struggle between modern Russian geneticists and Lysenko, a powerful member of the Communist Party. Lysenko introduced successfully certain improved agro-techniques, but was woefully lacking in knowledge of the science of heredity. Huxley first presents the basic facts of modern genetics. This is followed by a discussion of Michurinism, the genetical theory championed by Lysenko. Named for a Russian biologist of the 19th century, Michurinism teaches a modified version of the long since disproved theory of the inheritance of acquired characters. Lysenko's experimental claims have not been verified by scientists outside Russia. Much of his work was done without regard for scientific controls, without concern for the purity of his genetic material, and without statistical tests. The idea of causing hereditary changes by environmental changes is agreeable to Communist theory, since practical agricultural improvements might be expected to result in a short time on this basis. Unfortunately for the Communists, their theory does not follow the well established facts of heredity.

Heredity East and West contains a detailed, documented account of the remolding of the study and teaching of genetics and evolution to suit political desires in Russia. Lysenko tolerates only practical problems. Pure research is banned as being opposed to Communist thought. A total regimentation of thought in the fields of music, history, and philosophy as well as genetics has occurred in Russia. Apparently the Russians feel it necessary to regiment all mental activity for an oncoming war.

The author believes that although it appears inevitable that society is to undergo a greater centralization and organization, scientists should bitterly oppose any attempt of the state to make pronouncements on the truth or falsity of scientific facts. Biologists should strive to have the concepts of modern genetics and evolution incorporated into the general educational curriculum. I would recommend the reading of *Heredity East and West* by first-year college science students, chiefly for its beautiful description of the scientific method of working.

All scientists and friends of science should read this patiently written exposé of the Russian genetics affair in order to realize the threat of a totalitarian government to all scientific work.

SARAH B. PIPKIN

GENES, PLANTS AND PEOPLE. *Essays on Genetics.*

By C. D. Darlington and K. Mather. Blakiston Co., Philadelphia. $4.00. xxii + 187 pp. + 1 pl.; text ill. 1950.

Following on the heels of the author's recent *Elements of Genetics*, this volume presents a group of out-of-print essays, most of which appeared in *Nature* during the past 20 years. If there be a thread of continuity running through them, it is an historical one which traces the development of those genetic ideas which have come to be recognized as characteristic of the English school The essays are stimulating, as the writings of Darlington and Mather always have been, but, as usual, the elements of prediction and hypothesis loom large. These will not readily be discernible as such by the general student, for whom apparently the volume is intended.

C. P. SWANSON

GENETICS AND THE RACES OF MAN. *An Introduction to Modern Physical Anthropology.*

By William C. Boyd. Little, Brown & Co., Boston. $6.00. xviii + 453 pp.; ill. 1950.

This book, already assured of a wide and favorable popular reception, should be welcomed with equal enthusiasm by geneticists, anthropologists, and students of evolution. Boyd has given us a book which has long been needed. It may well mark, together with the 1950 Cold Spring Harbor Symposium on the *Origin and Evolution of Man*, the beginning of a new and highly fruitful union of human population genetics and physical anthropology in the study of the evolution and racial differentiation of mankind. The title and subtitle of the book, taken together, show the aim of *Genetics and the Races of Man* to be the union of fields that have been in the past only too remote from one another.

Boyd begins with a discussion of Possible Approaches to a Study of Man, a chapter wherein he points out the historical failures and shortcomings of the methods of physical anthropology in the past, and ends by emphatically stating the need to be that "to consider characters which are found to be determined by one or a definite number of genes, acting in a known manner." This leads him into an exposition of genetical principles, in particular those of population genetics, which occupies the next 4 chapters. Boyd discusses both static gene equilibria and the dynamics of changes in gene frequencies.

The next 2 chapters are devoted to considerations of the basis of human racial differentiation: first, The Influence of Geography on Racial Distribution; second, The Concept of Race. Having stressed the importance of geographic isolation and the probable role of selection in different environments in leading to characteristic skin color, eye color, etc., and having cleared away numerous mirages of misconception, Boyd comes to the heart of his discussion, namely, the blood groups and the use of blood group frequencies to study racial differentiation. From the use of blood groups in human classification, Boyd defines 6 genetic races which differ in the over-all picture of their blood group gene frequencies: a European (caucasoid) group; a hypothetical Early European group, now represented most fully by the Basques; an African (negroid) group; an Asian (mongoloid) group; an American Indian group; and an Australoid group. It is pointed out that widely separated populations may chance to have very similar blood group frequencies in respect to one or even more blood group systems (ABO, MN, Rh, etc.), but if a sufficient number of the systems is taken into account the true relationships emerge. Such a classification corresponds well with geography, and even in a broad way with previous anthropological views; but because it is based on genetically defined characters that do not affect the choice of mates, it affords an objective basis for the study of racial and populational differences.

In Chapters X and XI Boyd considers the possible use in a corresponding manner of Other Human Genes and Incompletely Analyzed Genetic Characteristics. The results to date are indeed meager. Taste capacity for PTC has proved itself useful. The secreting gene responsible for the presence of the A or B antigens in the body fluids and tissues other than the blood; middigital hair; and possibly color-blindness may be useful in this type of study. The vast majority of known human genes are virtually worthless, however, for they are mainly cases in which the normal allele is close to a frequency of 99% and the exceptional allele is 1% or less. This is because most of such variations are pathological or definitely harmful in nature. Most normal human traits, like variations in skin color, complexion, stature, skull shape, etc., are of unknown and probably complex genetic causation. Boyd comes to the conclusion that few genes beside the blood group genes are available for a sound basis of studies in physical anthropology. This is no doubt true at the present time. However, it may well be that more persistent search for normal human variations which are common will be rewarded by the discovery of a considerable number of traits to add to these diagnostic characters. For example, a recent study (Glass and Kistler) has shown that hyperextensibility of the distal joint of the thumb is very common (occurring in 24.7% of the white population studied), is inherited as a simple Mendelian recessive, occurs with different frequencies in caucasoid and negroid groups, and is ideal for such studies from the standpoint of ease and accuracy of scoring. What is necessary is that a considerable number of anthropologists and human geneticists turn their attention to studies of this kind, and that determination of the mode of inheritance be based on population data rather than on a limited number of pedigrees.

The 2 final chapters of the book are devoted respectively to Man's Past and Man's Future, and give a glimpse into the revelations which may await a further application of the new methods. A lengthy series of appendices (73 pp.) includes a fuller treatment of the statistical methods needed by workers in this field. These are clear and concise, but unfortunately suffer from a considerable number of errors in the formulae, no doubt due to haste or oversight in proof-reading. It is to be hoped that these will be quickly corrected in future printings. There is an adequate index.

BENTLEY GLASS

INHERITANCE IN DOGS *with Special Reference to Hunting Breeds.*

By Øjvind Winge. Comstock Publishing Co., Ithaca, New York. $3.50. x + 153 pp. + 5 pl. 1950.

Most of the data included in this volume are derived from the Danish Stud Book rather than from experimentally observed matings. The breeds covered are the Irish, Gordon, and English Setters; Cockers; Bird Dogs (short and wirehaired); Pointers; Wirehaired Foxterriers; and Dachshunds. Part I gives the basic facts of Mendelian heredity at the outset. It deals briefly with the genetics of structural characters and abnormalities, and at length with the inheritance of various coat colors.

The genes for coat color are denoted alphabetically, a method necessitating reconciliation with pre-existing terminology before comparisons can be made. They include: *A*, epistatic red; *B*, (yellow) red; *C*, self color with multiple alleles, c^{bi}, bicolor, c^{sa}, saddle, c^{br}, brindle, c^{ma}, mask, c^{i}, epistatic black; *D*, intense vs. dilute; *E*, brown; *F*, color vs. albino; *G*, wild-color producing "wolf" color with *B* and *E*; *H*, harlequin; *I*, "interaction" factor needed for c^{bi} to produce bicolor; *R*, roan; *S*, small spots (belton); *T*, whole color vs. white mottled; *Z*, intensity vs. light color. Genes for structural and coat characters are *K*, short vs. long hair; *W*, wire vs. soft hair; *L*, short crooked vs. long straight legs. Six matings between breeds are described.

Part II is a more detailed discussion of the genes operating to produce the different colors of the various breeds. Genetic formulae are applied to specific pedigrees and individuals. This effort is to educate and interest the intelligent breeder in the application of Mendel's law. Careful study and mastery of that law should precede any attempt to utilize the data presented. The colored plates illustrating various genetic types are simple but excellent. An adequate bibliography is appended.

C. C. LITTLE

THE NEW YOU AND HEREDITY. *Rewritten and amplified edition.*

By Amram Scheinfeld. J. B. Lippincott Co., Philadelphia and New York. $5.00. xxii + 616 pp. + 13 pl.; text ill. 1950.

This revised and enlarged edition deserves the popularity accorded the first edition 11 years ago. It exceeds the earlier edition by nearly 200 pages. Most of the chapters have been rewritten and expanded to contain new information about human heredity. The most notable additions are in chapters on blood, sex, and race.

The author's objective is to present information and ideas about heredity in man and to indicate the importance of this information to all who are interested in human biology and welfare. This task is admirably accomplished. Diverse opinions are presented where they exist, with some but not exhaustive attempts to reconcile conflicting evidence and interpretations.

Scientists may object to such colorful phrases as a "... gene goes forth hopefully ..." and "... genes happily fall to work ...." Many may judge the book to be unscientific because it is much too readable.

E. L. GREEN

MAN IN OUR IMAGE: *The Same Man the Eugenist Would Make.*

By S. Auk. Commercial Printing Co., Lexington, Kentucky. $3.00. xvi. + 333 pp. 1940.

The author would have man improve the human stock in order more truly to represent God in whose image the author believes man was made. He proposes a peculiar sort of matriarchy in which all women would bear children but only a few "best" men would be fathers by means of artificial insemination. Women, educated to desire "better" children, are to choose the fathers. Physically attractive individuals are also mentally and spiritually superior, according to the author, so women can be guided easily in choosing prospective fathers. No competent student of human heredity would agree with such a basis of selection. The author longs for a period when all people will be genetically the same; i.e., all will be "good." Several times he compares his method of human betterment to that of the poultryman who breeds from one cock and many hens. Unlike the barnyard fowls, our age-old system of monogamous marriages would be retained—the author thinks—in the new order. The husband would serve as a sex partner to the mother and a foster father to her "superior" children. To justify his drastic plans for changing the emotional lives of most men thus denied real fatherhood, the author resorts to a bit of Communist philosophy: a noble end justifies any means to attain it. As the mother of three children I do think the author underestimates man's desire for children of his own.

One cannot agree with the author that a genetically homogeneous human population is desirable. Although there is certainly some room for improvement in the human stock, a genetically variable population would seem better able to cope with changing conditions than a genetically homogeneous one. The author is hopelessly confused with respect to genetic and cultural inheritance. He professes sympathy with the negro race but predicts that negro mothers would seek white fathers for their "superior" children in his eugenic plan.

The author of *Man in Our Image* is obviously sincere in his aims but misinformed in his ideas of human inheritance. As long as such an individual lives in a democracy, no great ill may come of his writings, but should he become a sort of eugenic Lysenko in a totalitarian state, he would wreak havoc.

SARAH BEDICHEK PIPKIN

AN INTRODUCTION TO POPULATION GENETICS.

By Ching Chun Li. National Peking University Press, Peiping, China; distributed by O.S.C. Cooperative Association, P.O. Box 491, Corvallis, Oregon. $5.00 (paper). 321 pp. 1948.

Genetics was long ago extended beyond the laboratory, greenhouse, and garden plot to deal symbolically and actually with the effects of inbreeding, outbreeding, selection, and mutation upon the constitution of natural living populations. The change required new concepts and tools. Those now available, supplied by Wright, Haldane, Fisher, and to a lesser extent by a score of others, are widely distributed in genetic and mathematical literature of the last 30 years.

This work by C. C. Li appears to be the first to attempt in book form to present the principles of population genetics in an orderly fashion. Since the emphasis is on the principles rather than the facts of population genetics, the text is largely mathematical. A biologist should have a modest acquaintance with the calculus, series, and matrices to use the book effectively.

Li deals first with the Hardy equilibrium principle; second, with special problems of multiple alleles, sex-linked genes, autopolyploids, self-sterility alleles, and two pairs of genes; and third, with effects of various theoretical breeding systems, of selection, and of mutation on the gene frequencies in populations.

So far as it goes, the text is orderly and well written. It may be seen to draw heavily upon the writings of the pioneers, especially Wright. Those who are interested in the applications of the principles to practical problems of plant and animal breeding will be disappointed, since the author does not deal with quantitative traits.

E. L. GREEN

POPULATION GENETICS AND ANIMAL IMPROVEMENT *as Illustrated by the Inheritance of Egg Production.*

By I. Michael Lerner. Cambridge University Press, New York and London. $5.50. xviii + 342 pp. 1950.

Lerner has written this book to stimulate interest rather than to answer questions. He points out that poultry breeding has gone through three phases and is now in a fourth. The first stage was the selection of the best phenotypes for reproduction. The second includes the Mendelian approach initiated by Raymond Pearl. The third phase naturally followed the second when Goodale proposed that egg production depends on many physiological traits, each having its phenotypic value. The fourth phase suggested is a combination of the strictly Mendelian and the strictly biometrical approach.

Low heritability of many of the physiological characters believed to affect egg production has led to a polygenic approach as the best means for developing a breeding system for increased egg production. In Chapter 5 six propositions in population genetics are discussed, and this is followed by an attempt to synthesize these in a breeding program.

Succeeding chapters are devoted to such important subjects as genetic relationship, heritability, selection, expected genetic gains, mating systems, the basis of selection, interrelation between traits, selection indexes, and miscellaneous topics. The final chapter is concerned with the outlook for the future. The author expresses the opinion that the genetics of egg production in the fowl is still in its infancy. He points to a great need for definite experiments planned specifically in the field of population genetics.

On the whole, this book deals with a very difficult field in a most stimulating fashion. It serves a very useful purpose in calling to general attention the great importance of population genetics in the field of applied genetics.

F. A. HAYS

THE THEORY OF INBREEDING.

By Ronald A. Fisher. Oliver & Boyd, Edinburgh and London. 10s. 6d. viii + 120 pp.; ill. 1949.

Inbreeding, crossbreeding, and selection are the principal genetic tools available to breeders of domestic animals and plants. The theoretical consequences of various inbreeding plans have been worked out in the past. In this book, R. A. Fisher, who has himself made many notable contributions to theoretical genetics, presents a unified theory of inbreeding. The elegance of Fisher's treatment lies in the use of a table which shows the frequency with which each mating type of one generation produces the mating types of the following generation. The table may be regarded as a generation matrix and the roots of the matrix may be calculated. The dominant latent root yields the rate of progress toward homozygosity for the breeding system under investigation. The method is useful for any *regular* inbreeding system. It serves as a means of comparing the relative effectiveness of various methods.

The text will be found difficult by biologists not acquainted with matrix algebra, but it will reward them if carefully studied. There is no index, nor any reference to contributions by others, nor any reconciliation of Fisher's procedure with procedures used by others for developing the theory of inbreeding.

E. L. GREEN

LES CHROMOSOMES DES VERTÉBRÉS.

By Robert Matthey. F. Rouge, Lausanne, Switzerland. S. Fr. 48.00 (paper). 356 pp.; ill. 1949.

There have always been biologists who looked down their noses at the cytologist, especially the sort interested in chromosomes. If by any chance they should get hold of this book and glance through it superficially

they may put it aside quite convinced they have found evidence to uphold their opinion of chromosomology. What would be simpler, they might say, than to count the chromosomes of this and that animal, or to determine what kind of sex chromosomes, if any, it has? And yet, after 50 years of work by an international group of cytologists, there is still disagreement about the true chromosome number in more than a score of species, including some as common as the guinea pig, the fowl, the cat, and man. Of course the more thorough reader, or one familiar with vertebrate chromosomes, will be less cynical about the scientific achievement summarized in this book. He will be impressed by the amount of patient and painstaking effort spent by innumerable workers of many nations in working out the caryotype of vertebrates. Naturally there are also many superficial and untrustworthy reports in the literature—and the reader is not left in the dark, for Matthey does not mince his words. As it is, there are many troubles to beset the student of vertebrate chromosomes, above all the difficulties of adequate preservation of dividing cells. Vertebrate chromosomes have a tendency to clump together in the metaphase plate and therefore without the most perfect fixation counts of chromosomes are meaningless. It is not accidental, then, that in the first chapter Matthey deals with technique, especially that of fixation. Yet even where the fixation is good, if we consider that vertebrate chromosomes are often small and the number rarely under 30, we will understand that even excellent observers may get different results. In addition there are psychological factors which Matthey rightly stresses: it may be the findings in a related group of animals, or the result of genetic work (the genetic heterogamety of female amphibians and birds has certainly influenced those who claim to find cytological heterogamety, for which, as Matthey shows, there is no basis); or it may be a cytogenetic theory which can lead the observer astray. All these factors are considered as each contribution is weighed in the exhaustive and critical discussion of the literature. A special chapter deals with sex chromosomes. The presentation here is a model of an authoritative and critical review. The last chapter presents a study of comparative caryology and shows how this field can contribute to the analysis of evolutionary relationship between animal groups.

As the author points out in the Preface, the main effort of cytology today is going in directions different from those treated in this monograph—and it is therefore a good time for an up-to-date and a critical summarization of the field. If this summary is not conclusive, that is mainly due to difficulties inherent in the material rather than any lack of effort or ability on the part of its investigators. At least Matthey's book proves that even counting chromosomes can be far from a dull undertaking and can have implications for many general biological problems. The 35 plates with 442 black-and-white figures of metaphase plates are a valuable feature of the book, though it would help if the reader were told what type of cell each one was taken from. All who in any way have to deal with vertebrate chromosomes are in debt to Matthey for having collected and critically sorted the widely scattered information, and not less for having it put together in an eminently readable fashion.

HANS RIS

SYMPOSIUM ON CYTOLOGY.

By William L. Doyle, Hans Ris, Franz Schrader, and C. Leonard Huskins. Michigan State College Press, East Lansing, Michigan. $1.50 (paper). viii + 69 pp. 1951.

Entrance of the Michigan State College Press into the field of biological symposia is marked by the publication of this slender volume of 4 papers. The choice of subjects is necessarily limited, but well balanced. Doyle and Ris approach the subject from the chemical point of view, the former by discussing the quantitative aspects of the histochemistry of phosphatases, and the latter by bringing up to date the subject of chemical studies of the chromosomes. In both papers, the value and the need of exacting quantitative approaches are emphasized. Schrader represents the descriptive school in his discussion of the hypotheses of mitosis, and one reads his article with the realization that there remains a great need for more critical morphological studies which will provide a framework of reference into which the quantitative physico-chemical data must fit. Huskins' essay is an attempt to utilize the science of cytology as an example of the role of science in society: its methods of analysis, correlation, and deduction, and its impact on social philosophy, the latter arising out of its willingness to experiment, to reject when necessary, and to view scepticism as a healthy and fundamental ingredient of the attitudes which lead to progress in all fields of human endeavor. The volume is a modest but encouraging beginning for the Michigan State College Press.

C. P. SWANSON

THE MECHANISMS OF CELL DIVISION. *Ann. N. Y. Acad. Sci., Vol. 51, Art. 8.*

By M. J. Kopac and 18 other authors. New York Academy of Sciences, New York. $3.50 (paper). Pp. 1279–1546; ill. March 23, 1951.

The cytological advances of the last quarter century in the fields of cell division and cytoplasmic structure and function have been overshadowed by those made in the adjacent fields of cytogenetics and cytochemistry, but since practically every biological subdivision has its cytological vector, no aspect of cytology can be profitably neglected. The present volume indicates

that while other aspects of cytology have gained popular ascendancy, substantial studies have helped to elucidate the mechanisms of cell division, particularly those studies which have approached the problem through the phenomena of inhibition. Cancer research, supported by large sums of money, has done much to stimulate interest in this area, and many of the results reported in the 16 articles bear on, or are directly related to, the activity of tumors and malignancies. It is not possible to review in an adequate fashion each contribution, but the volume in general provides an up-to-date appraisal of the status of the field, as well as a provocative guide to future studies. The charming essay written by E. G. Conklin, which opens the volume, is well worth the price of the entire monograph.

C. P. SWANSON

CYTOLOGICAL TECHNIQUE. *The Principles and Practice of Methods Used to Determine the Structure of the Metazoan Cell. 3rd Edition.*

By John R. Baker. John Wiley & Sons, New York; Methuen & Co., London. $1.75. viii + 211 pp. ill. 1950.

This "3rd edition" is an exact reprinting of the 2nd edition. which has already been reviewed in this journal (*Q.R.B.*, 23: 53, 1948). A valuable book.

GENERAL AND SYSTEMATIC BOTANY

NATURAL HISTORY OF THE DANISH LICHENS. *Original Investigations Based upon New Principles. Part VIII.*

By Olaf Gelløe. Einar Munksgaard, Copenhagen. Dan. Kr. 40.00 (paper). 81 pp. + 122 pl. 1950.

This volume is a continuation of the work reviewed in the June 1950 issue (*Q.R.B.*, 25: 220. 1950). Color plates give accurate detail of 8 genera and 2 lichen parasites with innumerable black-and-white drawings of microscopic sections. For example, the genera *Usnea* and *Alectoria*, at best mere wisps and trailings of vegetative growth without more form than a tangle of unruly string, are given some vestige of unity. Without benefit of wordy definitions, lichenological terms are here served direct to eye and mind with meaning. The text is brief, perhaps too brief in the discussion of the controversial genera *Umbilicaria* and *Gyrophora*. Certainly, this would have been the logical place and time for a fuller discussion of Scholander's hypothesis of apothecial development. The wealth of microscopic cross-sections presented by the author should have furthered some investigation into this very obvious problem. However, the author has defined his objectives along conservative lines, and he adheres to them.

GEORGE A. LLANO

A MONOGRAPH OF THE LICHEN FAMILY UMBILICARIACEAE IN THE WESTERN HEMISPHERE. *Navexos P-831.*

By George Albert Llano. Office of Naval Research, Department of the Navy, Washington, D. C. Paper. vi + 281 pp.; ill. 1950.

This is the first monograph of a lichen family to include the entire Western Hemisphere. It is based upon the detailed examination of over 3000 specimens from the Canadian Arctic, Greenland, all of Antarctica, North and South America and adjacent islands, including Hawaii, and is descriptive of the history, ecology, geographical distribution, morphology, and systematics of the family. The author displays a thorough knowledge of the group based upon his extensive collecting from many of the listed geographical areas, in addition to study of herbarium specimens.

The treatment of the family is based upon the monograph of Scholander (1934), who arranged the Umbilicariaceae according to apothecial structure in contrast to spore and thallus. Llano differs with Scholander in respect to generic terms only. He proposes 5 genera, as follows: *Lasallia*, raised from sectional status; *Agyrophora*, equivalent to Scholander's section Anthracinae; *Omphalodiscus* and *Actinogyra*, retained; and *Umbilicaria* in place of *Gyrophora*.

The first section of the book contains the rationale of the systematic treatment and a general discussion of the ecology, distribution, chemistry, and relations of the family. The remainder of the monograph is devoted to systematics, including keys, and detailed descriptions of the morphology and distribution of each species. The analysis of each species stresses apothecial, spore, thallus, and gross morphology. Comparative tables and text illustrations supplement the text.

The book was printed by offset lithography. The format is good, the type clear, the figures and plates also good. There are a number of printing errors, e.g., Probilof for Pribilof (p. 122) but they are not serious.

The book will serve as a most useful reference for students of the lichens. Due to its scope and style, it is to be recommended to non-lichenologists as an excellent example of monographic treatment.

G. A. EDWARDS

WILD FLOWERS OF THE CHALK.

By John Gilmour; colour plates by Irene Hawkins. Penguin Books, West Drayton, Middlesex; London; New York; Baltimore. 75 cents. 16 pp. + 16 pl. 1947.

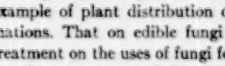
EDIBLE FUNGI. *Revised Edition. King Penguin Book.*

By John Ramsbottom. Penguin Books, London; Allen Lane, Baltimore. 75 cents. 46 pp. + 24 pl.; text ill. 1948.

A Book of Mosses. *King Penguin Book. By Paul Richards. Penguin Books, Harmondsworth, Middlesex; London; Baltimore.* 75 cents. 40 pp. + 16 pl. 1950.

The amateur botanist will find much of interest in these three well-written and beautifully illustrated King Penguin booklets on selected aspects of the British Flora. The first deals with those flowering herbs which are restricted to the chalk areas of the southeast coast of England, and provides a limited but excellent example of plant distribution determined by soil formations. That on edible fungi provides an historical treatment on the uses of fungi for food, culinary advice for the gourmet, and descriptions for identification. The last of the 3 booklets treats the mosses in a sympathetic and understanding manner. The mosses represent the least known of our plant forms, but the discussions by Richards of their life-history, habitats, and collecting bear out the fact that these are a fascinating group with a definite esthetic appeal. Even if one is interested only in the illustrations, these books are well worth their modest price.

C. P. Swanson



A Monograph of Clavaria and Allied Genera. *By E. J. H. Corner. Oxford University Press, New York and London.* $21.00. xvi + 740 pp. + 16 pl.; text ill. 1950.

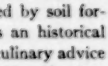
This volume represents the first of a projected series of monographs, publication of which is sponsored by the Annals of Botany Company. It is a taxonomic treatment of the Clavariaceae, or coral fungi. For students of these organisms, the need for such a work is great because of the passage of almost 30 years since the appearance of the last monographic treatments of these forms in North America by Burt in 1922 and Coker in 1923.

The work represents the fruits of 25 years of study by E. J. H. Corner, principally in England and Malaya, and has resulted in the unraveling of many perplexities which arise when a mycologist, trained in temperate regions, is confronted with tropical material. The monograph is world-wide in scope, and thus differs from all predecessors, which deal only with a specific region.

Twenty-seven genera are recognized, of which 9 are new. By actual count, 564 species and 83 varieties are included. The larger genera with 30 or more forms include *Clavaria*, *Clavulina*, *Clavulinopsis*, *Pistillaria*, *Pterula*, *Ramaria*, and *Typhula*. About one quarter of the species are too inadequately known for certain identification, but the remaining three quarters of the known world flora of clavarioid fungi should be identifiable with this monograph. There are both natural and artificial keys to the genera, and microscopic and macroscopic descriptions of species. The numerous well-executed text figures and colored plates add greatly to the usefulness of the monograph.

It would perhaps be an understatement to say that this monograph will remain a landmark to students for years to come. Both the author and the publishers are deserving of the highest praise for their product. Yet the price of over five pounds is prohibitive, even under the present circumstances of a devaluated pound.

F. T. Wolf



Mushrooms in their Natural Habitats. *Two Volumes. Limited Edition. By Alexander H. Smith; stereoscopic kodachrome photographs by William B. Gruber. Sawyer's Inc., Portland, Oregon.* Vol. I: $8.50; Vol. II: $18.00 (available only as complete set); separate reels (without text and container): $11.00. Vol. I (Narrative Text): xiv + 626 pp. Vol. II: Matching simulated book container holding one View-Master Stereoscope and Fabrikoid bound envelope book which contains 33 mushroom reels. 1949.

This magnificent work is dedicated to the memory of Calvin Henry Kauffman, under whose inspiration and guidance the author was introduced to the study of the fleshy fungi. The text volume consists of an introductory part of 129 pages, intended for the lay reader as well as the technically trained student. After a brief introduction this part discusses the subject under the following headings: The Mushroom in Relation to Other Living Organisms; The Fruiting Habits of Fleshy Fungi; Lists of Edible and Poisonous Species; How to Collect Mushrooms and Prepare Specimens; Parts and Characteristics of the Mushroom Fruiting Body which can be Studied without a Microscope; Laboratory, Techniques and the Study of Microscopic Characters of Importance in the Classification of Fleshy Fungi with subheadings on The Use of Chemical Reagents, Microscopic Characters of the Gill Fungi, The Characters of the Basidiospores, Classification of Spore Types, Techniques for Studying Details of the Fruiting Body, The Tissues of the Fruiting Body and their Detail, The Hymenium, The Gill Trama, The Pileus, The Stipe, Microscopic Characters of Other Groups of Fleshy Fungi, Fleshy Ascomycetes, Basidiomycetes; How Mushrooms are Named; Mycophagy, with subheadings on Preparing and Cooking Mushrooms and Recipes, Mushroom Poisoning, and Growing Mushrooms. Especial attention is given to the chemical and anatomical characters the study of which is laying and elaborating the foundations for the newer systems of classification that are coming to replace the Friesian system which has been the prevailing one for over a century. There is a short key to the genera and some

of the species illustrated in color in Volume II. More detailed keys to the genera are given separately, and for each genus illustrated in Volume II a species key is given for the species illustrated. The first key is followed by technical descriptions of all 229 species illustrated. For each one is first given the name accepted by the author as correct in accordance with the recent studies and the International Rules for Botanical Nomenclature. Then come the recognized synonyms (if any). A brief general discussion is followed by notes as to the edibility of the species, its habit, habitat, and distribution. The technical description following consists of two parts, the first on the macroscopic characters and the second on the microscopic and chemical characters.

In accord with the more recent studies several Friesian names will not be found: *Omphalia*, replaced by *Xeromphalia* and *Omphalopsis; Amanitopsis*, replaced by *Vaginata; Entoloma, Leptonia, Nolanea*, and *Eccilia*, united to form *Rhodophyllus; Galera* (a preoccupied generic name), replaced by *Galerina* and *Conocybe; Hypholoma*, replaced by *Naematoloma* and some species of *Psathyrella; Psathyra*, a preoccupied name, the species distributed in *Psathyrella, Naematoloma, Agaricus* and *Panaeolus*. Non-Friesian names not found in the older standard literature but which recent studies seem to justify are: *Catathelasma*, for certain species of *Armillaria; Cystoderma*, for some species of *Lepiota* and *Armillaria; Leucopaxillus*, for some species of *Clitocybe, Tricholoma*, and *Pleurotus; Lyophyllum*, including species segregated from *Collybia, Mycena, Clitocybe*, and *Tricholoma; Laccaria*, some species from *Clitocybe; Limacella*, segregated from *Lepiota; Tubaria*, some of whose species have been assigned in the past to *Naucoria; Rozites*, segregated from *Pholiota; Gymnopilus*, made up of species segregated from *Pholiota, Flammula*, and *Naucoria; Psuedocoprinus*, essentially a nondeliquescing *Coprinus* and including some species formerly assigned to *Psathyrella*.

Following the pages devoted to the technical descriptions is a 5-page list of the Literature Cited, followed by a Glossary of over 26 pages and an index to the scientific names (including the synonyms) of the species discussed in the text.

Volume II is a box, looking like a bound volume, containing the colored illustrations and a stereoscopic viewer. It is the most interesting part of the work to amateur mushroom-lovers and of great scientific interest to the trained mycologist. Its 33 reels, as they are called, are disks of pasteboard, each carrying 7 paired Kodachrome transparencies. The total number of species illustrated is 229. With a few exceptions, the paired photographs were taken by Wm. B. Gruber, of Portland, Oregon, the photographic expert of the publishers. The greater number were taken with the cooperation of the author. Specimens were collected of practically all the forms photographed, and the author assumes responsibility for their identification. Where more than one specimen is shown in a photograph, some of the fungi are turned over or on their sides so that the gills and stipe are shown as well as the top of the pileus. As far as possible the fungi were photographed in their natural habitat. The accuracy and beauty of the coloring as shown in the photographs is admirable. In a very few cases, to which attention is called by the author, the shade is too pale or too brilliant, but in view of the variability of color of fungi growing under different degrees of illumination and humidity, these cannot be considered to be errors, and do not detract from the value of the pictures. The author and the photographer have sought to show examples of the more important genera, and in those genera with large numbers of species several are shown, especially where some species are edible or some poisonous. Thus 9 species of *Agaricus* are illustrated, 12 of *Amanita*, 8 of *Lepiota*, 5 of *Boletus*, 6 of *Hygrophorus*, 6 of *Marasmius*, 7 of *Mycena*, 13 of *Lactarius*, 5 of *Cantharellus*, etc.

It is to be hoped that this fine work will meet with sufficient interest by the public to encourage the author and publishers to produce supplementary volumes, illustrating in similar manner some of the genera not shown as well as more species, in particular from the South and East, regions that, because of the restrictions imposed by the War, could not be visited for making these sterographic photographs. The majority of those in the present work are from the Pacific Northwest, Northern Rocky Mountains, and a number from Michigan.

The binding is neat and the typography good. Only a few minor typographical errors were detected.

ERNST A. BESSEY

PLANTS OF BIKINI *and Other Northern Marshall Islands. By William Randolph Taylor. University of Michigan Press, Ann Arbor.* $5.50. xvi + 227 pp. + 79 pl. 1950.

Without "Operation Crossroads," the botany of Bikini and other northern Marshall Islands would still be as little known as that of many other Pacific islands. As senior biologist, Wm. Randolph Taylor was apparently given enough time and opportunity to make the first comprehensive collections of plants (except bacteria, Bacillariophyceae, and Dinophyceae), and on these this report is based. A short introductory chapter records the limited extent of previous botanical exploration of the Marshall Islands. The three following contain descriptions of the atolls and the marine flora and accounts of the characteristics of the land flora and of the detailed botanical features of each atoll. The greater part of the book (pp. 40–218) is occupied by the annotated catalogue of the plants, the accompanying descriptions, observations, and distribution records. The Latin diagnoses of the 19 new species and forms are

printed together (pp. 204–209). Only one of these novelties represents an imperfect fungus (*Botryodiplodia ochrosiae*), all others being algae. In several instances keys are provided for the identification of species and forms, as for 2 genera of green algae: *Halimeda*, 6 species and 2 forms of which are described as new; and *Caulerpa* 2 species and 3 forms of which are described as new. While Taylor himself identified practically all the marine algae, other groups were studied by specialists, whose assistance is always carefully acknowledged. The extent of representation of each group can roughly be judged by the number of pages needed for their treatment: the algae occupy p. 40–149, the fungi pp. 149–161, mosses pp. 161–162, and spermatophytes pp. 162–203. Throughout the book many valuable observations are recorded under species which merit such comments, as for *Pandanus* sp., coconut palm, and *Tacca leontopetaloides*. The latter is definitely an introduced element but is an important vegetable food source second only to the coconut. The carefully selected photographs show characteristic plant communities, individual species, and parts or sections of them. Plates 27–29 illustrate algae. A good index concludes this book. *Plants of Bikini* is thus a timely and important contribution to our limited botanical knowledge of large sections of the greater Pacific area.

THEODOR JUST

LABORATORY INSTRUCTIONS IN PLANT BIOLOGY. *Third Edition.*

By John B. Parker and John J. Clarke. C. V. Mosby Co., St. Louis. $1.25 (paper). 80 pp.; ill. 1950.

LABORATORY MANUAL FOR GENERAL BOTANY. *To accompany Fuller & Tippo's College Botany.*

By Wilson N. Stewart, Harry J. Fuller, and Oswald Tippo. Henry Holt & Co., New York. $1.25 (paper). vi + 62 pp. + 9 plates. 1950.

Neither of these manuals is designed as a laboratory accompaniment of any particular textbook, although the second would presumably be used in conjunction with the botany textbook by Fuller and Tippo. Parker and Clarke's manual is essentially a survey of the plant kingdom; it contains little relating to physiology, and nothing bearing on inheritance, ecology, or economic botany. In fact, inheritance is dismissed by saying that it cannot be satisfactorily demonstrated in a botanical laboratory without resort to materials obtained from commercial dealers—an oblique method of disposal, to say the least. The other laboratory manual is excellent, covering all of the phases of botany in adequate fashion. The experiments are clear-cut and definitive, and a number of good plates are available in the back of the manual for labelling.

C. P. SWANSON

AIDS TO BOTANY. *Third Edition.*

By H. J. Bonham. Bailliere, Tindall & Cox, London; U. S. distributor, Williams & Wilkins Co., Baltimore. $2.00. viii + 223 pp. + 1 folding table; text ill. 1950.

In revising his syllabus for beginning botany students, the author has added chapters on viruses, hormones, and the role of trace elements in relation to plant growth. Written for the purpose of preparing students for examinations, the book considers the plant kingdom from an evolutionary point of view, beginning with the simple and passing progressively to the more advanced groups. It has much to recommend it over the usual books of this type prepared in this country.

PRACTICAL BOTANY.

By W. O. Howarth and L. G. G. Warne. University Tutorial Press, London. 7s. 6d. viii + 159 pp. + 4 pl. + 1 folding map; text ill. 1950.

This is a laboratory manual designed as a companion volume for Lowson's *Textbook of Botany*, which was recently revised by the above authors. It is for use in elementary botany courses given in the upper forms of English schools or as introductory courses in the schools of higher learning, and hence depends largely on materials drawn from the English countryside. The laboratory exercises are well defined, and the intructions given clearly. The scope covered is quite similar to that given in most American college botany courses except that greater emphasis is given to the development of techniques and to good drawings. The compactness of the manual recommends it over the usual large and clumsy format currently popular for laboratory manuals in this country, but it is recognized that the difference in size stems largely from the use of prepared drawings in American courses.

C. P. SWANSON

GENERAL BOTANY LABORATORY BOOK. *2nd Ed.*

By Edward M. Palmquist and Loren C. Petry. W. B. Saunders Co., Philadelphia and London. $3.00 (paper). viii + 190 pp.; ill. 1951.

PLANT MORPHOLOGY

PLANT EMBRYOLOGY. *Embryogeny of the Spermatophyta.*

By Donald Alexander Johansen. Chronica Botanica Co., Waltham, Mass.; Stechert-Hafner, New York. $6.00 *(regular memoir edition, paper);* $14.00 *(special edition).* xviii + 305 pp.; ill. 1950.

Since 1886 the bryophytes and vascular plants together have been treated as the Embryophyta (Engler). Yet

plant embryology has never before been accorded adequate and comprehensive treatment. For this reason alone, the publication of *Plant Embryology* is a landmark in the history of plant morphology, especially that of gymnosperms and angiosperms. Moreover, the book presents so many new and little known facts, gleaned from a widely scattered literature and from personal investigations of the author, as well as conclusions based on these facts, that it will always be an indispensable reference work. The following comments are presented as a sampling of the contents of a book which few botanists can afford to overlook.

The history of plant embryology (pp. 1–12) can be divided into three epochs: first, from its hazy origin in Greek antiquity to 1877, the date of the discovery of fertilization by Strasburger; second, growth and development from 1877 to 1910, the beginning of exact descriptive plant embryology; and third, its maturation since 1910. Chapters 1–15 relate the known facts of the embryology of gymnosperms, here treated as 4 separate phyla. As far as possible, each chapter contains accounts of fertilization, the proembryo and embryo, polyembryony, and other interesting aspects. Chapters 16–21 are devoted to the embryology of the Anthophyta (here synonymous with Angiospermae). Following general considerations, one chapter treats of embryological types and variations, the next is devoted to special and comparative embryology, and the rest deal with apomictic embryogeny, adventitious embryogeny, and polyembryony. A glossary of the terms used, an index to phyla, orders, and families, and an index to genera and species followed by a list of recapitulatory tables conclude the book.

Angiosperm embryology can be divided into general embryology, and special and comparative embryology. The latter requires no further sudivision, whereas the former covers 3 subjects, namely embryonic morphology, embryonic physiology, and embryogeny, the latter the field most actively studied by plant embryologists. It includes 4 phases: a) embryogenesis (origin of embryo), b) embryotectonics (architecture of embryo); c) embryogenergy (destination or functions of embryo), and d) embryonomy (laws of embryonic development). Johansen uses a modified Schnarf system of embryonomic types, each with several variations. These variations are here recognized for the first time, largely as a result of the author's effort to list all species studied embryologically and to assign them to the 6 types. The laws of embryonomy, formulated by the disinguished French embryologist E. C. R. Souèges, can be best expressed by embryological formulae, based on the original French symbols as emended by Johansen. These fundamental laws are: a) the law of origin; b) the law of numbers (with rules of the first and second degree); c) the law of disposition; and d) the law of destination (with laws of the first and second degree). The first two laws refer to time relationships of the embryo, whereas the third law concerns its relations in space. To these four laws, Johansen adds the "law of parsimony," perhaps the most fundamental law of embryology. Freely stated, it reads as follows: "No more cells are produced by the embryo than are absolutely necessary." Several formulae (for different cell generations) are combined into recapitulatory tables, which in turn are applicable to many species. For instance, the recapitulatory table of *Senecio vulgaris* applies also to *Urtica pilulifera*, *Malva rotundifolia*, and *Muscari comosum*.

The 6 embryonomic types are "logically based upon the behavior of the two cells resulting from the first division of the zygote and their respective contributions to the sum total of the mature embryo." These types are considered to be so well established that they will always be recognized, whereas their 50 additional variations may have to be redefined or expanded to receive new variations as they become known. Of the 6 types, the Piperad type (with 3 variations) differs from all others in that the zygote divides by a vertical or nearly vertical wall. By comparison, the Onagrad type (with 15 variations), the Asterad type (with 9 variations), the Caryophyllad type (with 12 variations), the Solanad type (with 9 variations), and the Chenopodiad type (with 2 variations), all have transverse walls dividing the zygote. Independently, Souèges and Johansen proposed systems of classification of embryonal development. Johansen regards his system as more flexible and otherwise more advantageous. The two chapters (16–17) dealing with these general considerations are followed by the longest chapter in the book, devoted to special and comparative embryology. The arrangement and definition of orders and families follow essentially Hutchinson's *The Families of Flowering Plants*.

Although *Plant Embryology* "is emphatically not a taxonomical treatise," certain of its conclusions are of far-reaching taxonomic importance. For instance, the gymnosperms are broken up into 4 phyla, and dicotyledons and monocotyledons are not recognized as such, as they do *not* differ during proembryonic development. Various orders and many families such as the Anonales, Passiflorales, Palmae, and others, have never been studied embryologically. In other groups our knowledge is quite limited, e.g., *Carex panicea* is apparently the only member of the Cyperales ever studied embryologically (W. Hofmeister, 1861). Throughout the book the plants are referred to by the names given in the original publications pertaining to these species. In some instances, the author has furnished synonyms or has provided the names now accepted. It is unfortunate that *Microstrobos*, a new name for the podocarpaceous genus *Pherosphaera*, was published too recently to be included in the book. As Johansen treats this genus as the representative of a separate family, the latter may also have to be renamed.

According to the author, the manuscript of this book had been completed by 1944. He has, however, inserted all pertinent literature to the end of 1946. Apart from

the great service which the author has done for botany, it is hoped that this book will stimulate and increase interest and research in this long neglected but important stage in the life of higher plants.

THEODOR JUST

PLANT PHYSIOLOGY

AN INTRODUCTION TO PLANT PHYSIOLOGY. *McGraw-Hill Publications in the Botanical Sciences.*

By Otis F. Curtis and Daniel G. Clark. McGraw-Hill Book Co., New York. $6.50. xiv + 752 pp.; ill. 1950.

This volume has apparently developed in large part from courses in plant physiology given by Professors Curtis (deceased) and Clark at Cornell University. The usual main topics are covered, with major emphasis on classical plant physiology, especially water relations. Although designed to serve as an elementary textbook, the volume contains more material than can be readily handled by lectures in a one-semester course. Thus, it has the added feature of serving also as a limited source for advanced material in plant physiology. This, however, has been attained at the expense of conciseness.

An outstanding feature of the text is the comprehensive and critical treatment of each topic, as well as the up-to-date coverage. Data and interpretations are presented and evaluated in established fields and in those which are still controversial. At times, however, this approach, combined with too much detail, tends to obscure the necessary emphasis on fundamental principles. Unfortunately, there has been a minimum development of the biochemical aspects of the subject. The authors have reduced the treatment of those phases of physiology which require more than an elementary background in chemistry, physics, and mathematics. They believe that the classical features of physiology can give a clearer insight into the field, and, at the same time, have an important bearing on horticultural and agronomic practices. However, the biochemical fundamentals of photosynthesis, digestion, and respiration have been included. In my opinion, these have received neither the broad comparative nor detailed biochemical treatment which is so necessary for a modern course in plant physiology. Many of the fundamental advances and problems of plant physiology have become increasingly biochemical in nature. These can and should be made adequately available, with the aid of supplemental material, where necessary, to students who have the commonly assumed background of introductory chemistry and botany.

Some very stimulating problems and exercises, which involve an understanding and application of plant physiological principles, have been included at the end of each chapter, as well as in the appendices. These exercises have been used with fine success at Cornell. The value of the textbook has been further enhanced by extensive author and subject indices, as well as a list of references of the more important general articles, papers, and reviews appended to each chapter.

ALVIN NASON

TREE GROWTH AND RAINFALL—*A Study of Correlation and Methods. Smithsonian Miscellaneous Collections, Vol. 111, No. 18, Publication 4016.*

By Waldo S. Glock. The Smithsonian Institution, Washington, D.C. 30 cents (paper). 47 pp.; ill. 1950.

This paper reports a critical test of the covariation of tree growth as measured by the thicknesses of growth layers on increment cores, and rainfall. A detailed discussion is given of methods employed and results obtained from the study of growth layers, rainfall characteristics, and correlation between tree growth and rainfall in the Holman Pass area of north central New Mexico. Variations in diameter increment were found to follow variations of March–July rainfall from year to year with a correlation of very nearly 100 per cent at the immediate site of the trees.

SCOTT S. PAULEY

ECONOMIC BOTANY

SEAWEEDS AND THEIR USES.

By V. J. Chapman. Methuen & Co., London. 25s. xvi + 287 pp. + 20 pl.; text ill. 1950.

With the great growth of the marine algal industries and the attendant need for personnel familiar with the subject of industrial phycology this book, fulfilling a definite need, is timely. It is the first of its scope. The author's stated intent has been to present the ancient and modern seaweed (marine algal) industry to his public in readable form. To accomplish this he has assembled and presented a great deal of interesting material. Though skimpy in many details of the current industry, the author seems to have very well achieved his goal.

The format is that of a scientific treatise but considerable caution must be exercised in reading the book, since precision, unfortunately, has been sacrificed in some statements, perhaps in the hope of making the book more readable. Thus, one reads that "The ash of Phyllophora may contain as much as 1.3 per cent of iodine and is therefore as valuable as the species of Laminaria" (p. 63). This positive statement, completely disregarding the distribution, abundance, harvestability, and other comparative values of these organisms, is entirely contrary to the generally accepted opinion that *Laminaria* is by far the more important commercial alga of the two. Similarly the author says of seaweed products, "... the principal expense is usually in the collecting of the algae ..." (p. 24). It is

of interest in this connection to note that in a breakdown of the production costs of *Chondrus crispus* extractives by far the greatest portion of the production cost in 1946 (the time of completion of Chapman's manuscript) was for diatomite (filter aid). There is not even a reference to diatomite or diatoms in the indices; though the diatomite industry is probably the largest industry utilizing marine algal products directly.

The text is divided into 9 chapters completed in 1946, with a 5-page Addendum to cover progress from then until 1949. To acquaint the less phycologically learned of his readers, Chapman begins with a chapter in which the elements essential to understanding the remainder are set forth. Here the common and scientific names of the more conspicuous large brown algae (Phaeophyta) and the industrially important red algae (Rhodophyta) are given. British colloquial names are used as a rule in the text, and emphasis is given to the British and purely spectacular aspects of morphology and nomenclature. Good habit sketches of many of the species are included to illustrate these features. The distribution of these forms, both local and geographic, is considered. The industrially less important groups of algae are discussed briefly.

Chapter II, entitled "Mainly Historical," is just that—a rather delightful literary tour through the antiquities and incunabula of economic phycology. Two chapters on the kelp industry in reference to the production of iodine and potassium salts ("potash") follow, production of the latter having instigated the first North American industry of this kind. The author's lack of familiarity with the industrial uses of the sea weeds in North America leads him astray in various ways. For example, he implies that the industrial use of kelp in this country failed after the first World War, having been unable to survive without the subsidy of wartime economics (p. 2). While this is true in reference to inorganic salts, it was not until the years between the last two wars that the industrial utilization of kelps and *Chondrus crispus* for suspensoids was initiated. Both industries, after the customary initial hardships of chemical industries, are continuing to flourish.

The agar industry and the uses of agar, as well as the historical and current methods of production, form a single chapter. A more ethnic turn is taken in Chapter VI, in which the use of seaweeds as food for animals (including man) is followed from Norway to New Zealand. Here one finds tabular résumés of their food values and their value and use as fertilizers. The subject seems again to have been treated rather exhaustively except for the current and recent North American usages. Such information would not be available except through first-hand familiarity with the matter, since such industrial methods and results are not usually made public. The description of the Hawaiian seaweed biota (p. 19) sounds more like something from the Chamber of Commerce than like a scientific report of observations. For example, "lagoons" of the atoll type are almost completely absent from the Hawaiian archipelago and seaweeds, while frequently used as food there, are less important to the diet than lettuce or celery in a New Yorker's diet. However, this is no fault, the book not being intended as a purely scientific treatise.

Chapter VIII, Algin and Seaweeds in Medicine and the Home, begins with a discussion of the history and nomenclature of algal extractives and continues with topics such as the Chemistry of Algin, Production (of alginic acid, etc.), Occurrence, Collection of Raw Weed, and the Properties of the Salts. The remainder of the chapter is given over to a résumé of interesting uses one would never hope to find collected in one place, but there is little other than historical information regarding medical or home uses.

The final chapter presents the material with which the author had first-hand experience during the war years, while partaking in the survey of the available seaweed resources of the British Isles. Various methods of surveying and estimating crops and yields are discussed. With time, there has been a change from estimates based on appraisal of the surface made from boats to cooperation between grapnel-aided boat parties and shore parties, and to aerial photography and echo sounding. The very important subjects of sustained yield over a period of years and variation in annual yield are discussed.

In summary, Chapman's book, while not a work of scientific magnitude, is written in a chatty style and, will be read eagerly and widely, and enjoyed. One might wish that the author had mentioned the diatomite industry or had covered the current industry more thoroughly. One might wish for organization that would permit use of the book as a readier reference. Yet this small, inexpensive book will probably do more to disseminate widely a popular knowledge of the kelp industry than several expensive reference tomes.

MAXWELL S. DOTY

BRITISH HERBS.

By Florence Ranson; illustrations by Edith Longstreth Thompson. Penguin Books, Harmondsworth, Middlesex; Baltimore. 35 cents (paper). 203 pp. + 8 pl.; text ill. 1949.

According to the fly-leaf, this is a manual of herb-recognition written for the layman. For those who make use of herbs for medicinal or for culinary purposes, the manual will furnish a fund of information and lore on the history of herbs, their cultivation, description, methods of harvesting and preparation, and their uses for the sick and the well. For those who wish to become acquainted with herbs for the first time, and who may wish to grow them in the garden, the book will be found sufficiently complete to make it a useful addition to the gardener's library.

C. P. SWANSON

EAST AFRICAN AGRICULTURE. *A Short Survey of the Agriculture of Kenya, Uganda, Tanganyika, and Zanzibar, and of Its Principal Products.*

Edited by J. K. Matheson and E. W. Bovill. Oxford University Press, London, New York, and Toronto. $5.40. xvi + 332 pp. + 32 pl. + 4 map folders. 1950.

This beautifully printed and very readable book gives an excellent account of the development and present status of agriculture in British East Africa. It is the work of different authorities, practical farmers as well as professional agriculturists, and the editors themselves.

An introductory section contains short chapters on geography, land tenure, white settlement, native labor, native welfare, soil conservation, and the agricultural research institutes. In the section on European agriculture, which makes up the greater part of the volume, the major crops are discussed, with considerable emphasis on their future possibilities. They include cereals, cinchona, coffee, essential oils, fruit, groundnuts, papain, passion fruit, pyrethrum, rubber, seed-growing, sisal, sugar, tea, and wattle. There is also a chapter devoted to livestock. A third section dealing with African agriculture leaves something to be desired, as it is rather sketchy. Both the food and cash crops of the natives are discussed, but very briefly. Rice, cassava, maize, sesame, and legumes are the principal food crops; while coconuts, cotton, coffee, tobacco, and cashew nuts are important cash crops. There is an excellent account of the clove industry in Zanzibar.

Data regarding various miscellaneous matters are available in a series of appendices: geography, rainfall, temperature, population, exports, estate accounts and statistics, feeding the laborer, weights and measures, and tables for planters. An index and 6 maps conclude the work.

ALBERT F. HILL

WEED CONTROL.

By G. H. Bates. E. & F. N. Spon, London. 16s. viii + 236 pp. + 10 pl. 1948.

This book was intended for the British farmer and has little direct application to American agriculture or weed control. Much space is devoted to the statement of the British weed problem and to a discussion of cultural control methods and equipment. Specific weed problems are considered in detail. The chapter on Control of Weeds by Chemicals is a brief review of 25 pages, of which only 4 pages are devoted to the plant growth substances. The American farmer would be better advised to follow the recommendations of his State Extension specialist in weed control.

The American audience for this book will not be the farmer, for whom it is too technical, but rather the extension specialist himself and the research worker in weed control. The book gives a very clear picture of the weed control problem in Britain and the practices in use for the elimination of weeds from arable land, roadways, pastures and turfs, and waterways.

C. E. MINARIK

AN INTRODUCTION TO AMERICAN FORESTRY. *New Second Edition. The American Forestry Series.*

By Shirley Walter Allen. McGraw-Hill Book Co., New York, Toronto and London. $4.50. x + 413 pp.; ill. 1950.

The second edition of this textbook has been revised with the intention of bringing it up to date with current American forestry practices, techniques, and policies. The book is designed to give beginning forestry students a broad preview of the sciences upon which forestry is based and the art with which it is practiced in the United States. In most factural details the modernization of this book has been quite successful, but on the whole the reader is left with the general impression that American forestry is in much the same position as in 1938, when the first edition of this book appeared.

The promising evolutionary trend of American forestry in recent years from its earlier emphasis upon the extractive, protective, and engineering phases into the realm of soundly based silviculture and management has been largely neglected. The author has recorded valuable improvements in mechanization but at the same time has omitted reference to the accumulation of new basic biological facts which, though less spectacular, will doubtless exert a more profound and lasting influence on American forestry. For example, according to the publisher, in the new edition "the treatment of forest planting has been considerably developed, featuring changes from old hand methods to machine." Although such developments are eminently worthy of inclusion, the book gives no indication of the increasingly important attention being accorded by modern foresters to the genetic quality and adaptability of the plants to be set by such planting machines.

SCOTT S. PAULEY

ACTA FORESTALIA FENNICA—54 (1949), 55 (1948), *and* 56 (1949).

Society of Forestry in Finland, Helsinki.

In addition to articles in Finnish provided with German or English summaries, Numbers 54 and 55 contain the 2 following papers in English and German respectively: Trade in Forest Products between Finland and the United States of America (L. Runeberg), 161 pp.; Über Vorkommen und Sporenbildung von *Coleosporium melampyri* Kleb. auf verschiedenen Standorten und

Wirtspflanzen (O. Pohjakallio and O. Vaartaja). Number 56 is a special issue in memory of Aimo Kaarlo Cajander, who died in 1943. Besides a biography of Cajander by Y. Ilvessalo (in both Finnish and English) and a bibliography, Cajander's great work on the theory of forest types, originally published in German in 1926 and 1930, has been translated into Finnish and English and is published here under the title *Forest Types and Their Significance.*

PLANT PATHOLOGY.

By John Charles Walker. McGraw-Hill Book Co., New York, Toronto, and London. $7.50. x + 699 pp.; ill. 1950.

This manual, as stated by the author, aims "to provide the basic facts whereby the student may be introduced to the scientific foundations of plant pathology." It was written primarily as a textbook for use in beginning courses in plant pathology, but should be very useful to all students in plant pathology and to others who are interested in the growing of plants. The book includes chapters on selected diseases, both non-parasitic and parasitic, and also several chapters on problems which are at the present time considered vital and very important to all plant pathologists.

The major portion of the book is concerned with descriptions and discussions of selected diseases to provide the beginning student with the basic information needed. The parasitic diseases selected are in the main representatives of certain disease types or groups. These groups are based largely on the classification of the causal organisms. Thus there are chapters on diseases caused by, or in the words of the author, "incited" by bacteria, by phycomycetes, by imperfect fungi, by ascomycetes, by basidiomycetes, by viruses, by lower animal forms such as nematodes, and by higher plants. In many cases the life cycles of the causal organisms are emphasized and described quite fully. Methods of control, based on the latest information, are included. From his long experience in pathological work, the author has been able to select and to present that information regarding the diseases and their control which is particularly important to the student. The diseases which have been selected are mainly those which are common and important in the northern and northeastern states. This makes the manual particularly useful in those sections of the United States.

The special chapters on the history of plant pathology, the relation of environment to disease development, host-parasite relations, and disease control increase materially the usefulness of the book not only to the student but also to the research pathologist and the teacher. The historical chapter is particularly complete, especially for the early periods of the science up to about 1890, when active interest in plant disease investigations started in this country. In the other special chapters, such important problems as the relation of environmental conditions to disease development, the relations of host and parasite, types of parasitism, the introduction and dissemination of disease organisms, the chemicals which are being used for disease prevention and control, types of resistance to disease, and the methods used in the breeding of plants for disease resistance are presented in a form which should be useful to all plant pathologists. These are the problems which will continue to be of the greatest interest to investigators in plant disease work. A list including the more important literature references is appended to each chapter.

C. W. EDGERTON

GENERAL AND SYSTEMATIC ZOOLOGY

EINFÜHRUNG IN DIE ALLGEMEINE ZOOLOGIE *für Studierende der Naturwissenschaften, Landwirtschaft and Medizin.*

By Hans V. Lengerken. Walter de Gruyter & Co., Berlin. DM 12.50. vi + 201 pp.; ill. 1949.

In contrast to the many detailed and profound German zoology textbooks, the one in hand is decidedly brief—perhaps curt would be a better descriptive term to use. Thus, within pages 1 to 26 Lengerken describes the origin of life, the cell and its protoplasm, mitosis, meiosis, fertilization, heredity and its principles, and embryogenesis. A chapter on histology follows and then comes a long chapter on the organ systems, with examples from the entire animal kingdom rather than any single type. Reproduction and development and evolution follow. There is a 2-page list of the phyla and classes, a chapter on important parasites, and finally a chapter on agricultural, forest, and garden pests. There is an index and numerous illustrations. The briefness of description and discussion on most topics leaves the book open to criticism, but perhaps much of the missing material is intended to be given in accompanying lectures. Classification is subdued, but the scheme offered is hopelessly out of date. Darwinism, Lamarckianism, and Lysenkoism are explained, but no effort is made to point out the fallacies in the two latter concepts, nor is there any mention of neo-Darwinism. It should be evident that the type of material stressed here differs from that found in most textbooks, but it is difficult to determine satisfactorily the purpose for which this book was designed. Principles are neglected, and man as an animal is practically disregarded.

HENRI C. SEIBERT

LABORATORY INSTRUCTIONS IN ANIMAL BIOLOGY. *Third Edition.*

By John B. Parker and John J. Clarke. C. V. Mosby Co., St. Louis. $1.50 (paper). 110 pp. 1950.

This laboratory manual was formerly Part One of a manual for general biology. It is distinctly a survey of animal types, with major emphasis on the frog. Aside from a study of mitosis and meiosis, the more general aspects of biology are totally neglected. For example, no study is included of either embryology or genetics. Directions for the study of the dogfish in place of the perch are given in an appendix. The manual is lithoprinted on perforated pages, blank on one side. There are no illustrations.

GENERAL ZOOLOGY LABORATORY GUIDE.

By James T. Tanner. Burgess Publishing Co., Minneapolis. $2.25 (paper). iv + 144 pp.; ill. 1950.

A laboratory manual for a full year course in zoology. Part I is on the frog; Part II is a survey of the animal kingdom. There follow 4 briefer sections on ecology, cytology, genetics, and evolution. The manual provides many labeled drawings, with space for questions to be answered and problems to be worked. There is little emphasis on original drawings to be made by the students.

NOMENCLATOR ZOOLOGICUS. *Vol. V—1936–1945.*

Edited by Sheffield Airey Neave. The Zoological Society of London, London. £3. 13s. 6d. vi + 308 pp. 1950.

This volume includes over 18,000 generic names in the zoological literature between 1936 and 1945 inclusive, and the citations to the original descriptions. There are also 7 pages of additions and corrections to the listings in Vols. 1–4. These volumes are among the basic essentials for work in zoological taxonomy.

FIELD BOOK OF SEASHORE LIFE.

By Roy Waldo Miner. G. P. Putnam's Sons, New York. $6.00. xvi + 888 pp. + 24 pl.; text ill. 1950.

For several years there has been no adequate handbook to the seashore life of the northeastern Atlantic coast, and the publication of this book has long been anticipated. It is a guide to the marine invertebrates, principally the intertidal species, occurring from Nova Scotia to Beaufort, North Carolina. It was the original plan of this work, when announced some 15 years ago as "soon to be published," to include both the Atlantic and Pacific coast fauna. As finally limited, the book is nevertheless unequalled in scope and compactness. Never before in such a comparatively small, convenient volume, has there been so much valuable information. In addition to the usual descriptions of fauna found in a seashore book, here copepods, chaetognaths, rotifers, and other obscure forms are listed and figured. The illustrations, particularly the anatomical diagrams, are excellent, although there are some, especially of the bivalves, which lack essential details. The 24 color plates are good, but suffer from this particular publisher's long-standing difficulty with registration, which seems to be a shortcoming of all the "Field Book" series.

Unfortunately, errors of detail are far more numerous than they should be. Some will want to quarrel with the arrangement of major categories, and certainly the inclusion of the Phoronida among the Chordates will cause lively debate. More support may be found for lumping the Bryozoa (including the Endoprocta, however) with the Brachiopoda under the new phylum Prosopygia. The class Arachnoidea once again rears its archaic head, like Camoens' Neptune, out of the sea, adorned with *Xiphosura*, marine mites, and tardigrades, albeit divested of the Pycnogonida. Far more serious is the use of nomenclature which was discarded years ago—the names given are more often than not those in use 50 years ago. In some ways, this might be considered an advantage, since the animals in the older literature can thus be looked up by physiologists and ecologists. However, the author seems to be unaware of the meaning usually given to a second generic name in parentheses, and his parenthetical genera are usually synonyms, not subgenera. In several cases an entire name given in parentheses as an older synonym turns out to be either the current valid name, or a name under which the species was formerly known but which is actually that of an extraterritorial form. In justice it should be pointed out that most of these mistakes occur in the section on the mollusks, where taxonomic confusion unfortunately reigns supreme. In the pycnogonid section the entire nomenclature is that of 1879, in defiance of all subsequent revisions (including this reviewer's monograph, it must be said), so that two unnecessary species, actually juveniles of others, and some long discarded synonyms have been retained. Occasionally species are listed without any indication of their range, and some rarities which may never be seen by users of the book are included.

The explanation of these shortcomings is easily found by examining the Selected References. Listings, for the most part, seem to have been closed at least 20 years ago, and relatively few recent monographs are cited. In over 40 titles on coelenterates, the last dates from 1925; the nemerteans close with 1900; under the polychaetes there is only one title later than 1923.

This can hardly be called a list of important references, or be of much use as a guide to further study.

It is easy to pick out mistakes, and no general work of this sort can be expected to be free of them. It is rare in these days to find anyone willing to tackle such a task as this, and we must congratulate Roy Waldo Miner for seeing it through. Nevertheless, it is to be hoped that a revised edition will not be too long delayed, for while the book, even as it stands, is useful, improvement could make it indispensable.

JOEL W. HEDGPETH

SEA ANIMALS AND HOW TO DRAW THEM.

By Amy Hogeboom. Vanguard Press, New York. $1.75. 39 pp.; ill. 1951.

Ninth in Miss Hogeboom's series of drawing manuals, the present one deals with the larger animals of the sea—only the penguin can be considered to be a small marine inhabitant amongst the whales, sharks, and polar bears. As in previous volumes, the simplified instructions for drawing use photographs as the subject from which a drawing is progressively built up by lines and curves.

NAME THAT ANIMAL. *A Guide to the Identification of the Common Land and Fresh-water Animals of the United States, with Special Reference to the Area East of the Rockies. Revised Edition.*

By Ernest C. Driver; with drawings by Olive Driver. Published by Ernest C. Driver, 119 Prospect St., Northampton, Mass. $6.50. 558 pp.; ill. 1950.

This book provides practical keys to the identification of land and fresh-water animals. It also makes use of external and readily visible identification characters so that the amateur zoologist will have little trouble in naming the animal. For this reason the book can be used in the field, "where dissection facilities are seldom available." In order to get a better picture of the terms and characters used, there are numerous suitable illustrations by Olive Driver. There is an introductory chapter on classification and study techniques. Furthermore there are sections on eggs and tracks to assist the person in the field. Each chapter starts with a discussion of the interesting points about the animals for which there is a key. It then concludes with general references for further reading. These reading lists are not complete but are well selected. In view of the considerable amount of work that must have entered into the writing and illustrating of this book, it is a pity that no index was included.

LORUS J. & MARGERY J. MILNE

FORAMINIFERA. *B. A. N. Z. Antarctic Research Expedition 1929–1931 under the command of Sir Douglas Mawson. Reports—Series B (Zoology and Botany). Vol. V, Part 6.*

By Walter J. Parr. Published by the B. A. N. Z. A. R. Expedition Committee and issued through the Barr Smith Library, University of Adelaide, Adelaide, Australia. Forty shillings sterling (post free)—paper. Pp. 233–392 + 13 plates; text ill. 1950.

This excellent work, which concerns dredgings and shore sands from 4 distinct areas: (1) along the Antarctic continent from lat. 49°37′E. to lat. 138°28′E.; (2) Kerguelen and Heard Island; (3) Macquarie Island; and (4) the south coast of Australia, describes in great detail the Foraminifera obtained from 36 samples. A total of 453 species and varieties are recorded, of which 137 species and varieties are described as new. Seven genera are new: *Pelosinella* (Saccamminidae), *Plectotrochammina* (Trochamminidae), *Planispirinoides* (Ophthalmidiidae), *Siphoglobulina* (Polymorphinidae), *Siphouvigerina* (Buliminidae), *Ceratobuliminoides* (Discorbidae), and *Elphidioides* (Nonionidae). The large number of new forms described is partially due (a) to the inclusion of two rich samples, taken off Tasmania, and which contained many undescribed species; and in part (b) to earlier erroneous identifications, many forms of which have here been described as new. However, many of the new species described are based on extremely rare occurrences. Seventeen new species are based on single specimens, 3 on 2 specimens occurring at different stations, and 5 are based on 2 specimens only.

Eighty-two genera, including 196 species and varieties, are described from 13 antarctic samples of which 139 species do not occur outside the Antarctic. The fauna includes many widely occurring cold water species, the distribution of which is controlled more by temperature than depth. The occurrence of large numbers of lagenid Foraminifera from the Antarctic is notable.

Eighteen samples were examined from the Kerguelen area. These contained 64 species, dominated by calcareous perforate forms. This fauna contains a number of antarctic elements. From Macquarie Island 2 samples were examined, and 19 species recognized. Although Macquarie Island is closer to the Antarctic continent than Kerguelen, only one typical antarctic species was found there. Many common antarctic species found at Kerguelen are absent, and the fauna off this island has little in common with faunas found off the subantarctic islands of New Zealand.

From the Australian area, 267 species and varieties were recognized in the 3 samples examined, the 2 from the east coast of Tasmania being the richest, with 187 species in one and 158 in the other sample, of which 70 are described as new. A notable feature of these 2

samples is the presence of a large number of Indo-Pacific forms, ranging from the Philippines southward along the east coast of Australia. This distribution is controlled by the warm Eastern Australian current.

The descriptions are supplemented by 8 informative text figures and 15 beautifully executed plates. Especially good are the lucid plates of *Fissurina* and *Parafissurina*, showing many features of the internal anatomy so often missed by previous workers. This treatise will long endure as a classic for these southern faunas and will be indispensable to the student of the Foraminifera.

ALFRED R. LOEBLICH, JR.

THE INVERTEBRATES: *Platyhelminthes and Rhynchocoela. The Acoelomate Bilateria. Vol. II.*

By Libbie Henrietta Hyman. McGraw-Hill Book Co., New York, Toronto, and London. $9.00. viii + 550 pp.; ill. 1950.

This monograph is the second volume in a treatise on *The Invertebrates* and deals with the flatworms and the nemertines, which are considered as distinct phyla, the Platyhelminthes and the Rhynchocoela. The volume presents a general account of the morphology, embryology, physiology, ecology, and phylogeny of these forms. The classification extends only to suborders in the class Turbellaria and to orders in the other groups, so has limited value for specialists. The subject matter is arranged in 3 chapters, the first of which is devoted to a discussion of bilaterality in animals. There is a review of cleavage patterns and larval types, of mesoderm formation, metamerism, and organogenesis. In certain instances the interpretations give the impression of dogmatism in dealing with controversial subjects and are at variance with widely-held opinion. The failure to distinguish between strobilation and metamerism, and the statement that cestodes are segmented worms, may be cited as examples.

The second chapter (pp. 52–458) is arranged under the headings Turbellaria, Trematoda, and Cestoda. The section on the Turbellaria, a field in which the author is one of the leading students, presents a comprehensive survey of the general features of the class and the orders. The sections on the Trematoda and Cestoda provide a good introduction to these groups, and in that on the digenetic trematodes, the diagnostic characters and life cycles are listed for many of the families. The chapter on the nemertines is featured by the publications of W. R. Coe, eminent student of the group, and gives an adequate account of the characteristic features of these worms.

The historical narratives, though brief, give interesting introductory details; the bibliographies are extensive and include the more significant literature; and the figures, all original or taken from original sources, depict pertinent features of anatomy and development. The work is well suited for reference purposes and is probably the best general treatment of the groups now available in the English language.

H. W. STUNKARD

STUDIES IN THE ACHATININAE, A GROUP OF AFRICAN LAND SNAILS. *Bull. Mus. comp. Zoöl., Harvard Coll., Vol. 105, No. 1.*

By Joseph C. Bequaert. Museum of Comparative Zoology, Harvard College, Cambridge, Mass. $10.00 (paper). 216 pp. + 81 pl.; text ill. 1950.

This work is a companion to the same author's monograph of *Strophocheilus*, recently reviewed in these columns (*Q.R.B.*, 23: 358. 1948). *Achatina* occupies the same environmental niche in the Old World as *Strophocheilus* in the New World, the principal difference between the two seeming to be the greater plasticity of *Achatina*. Colonies of *Strophocheilus* introduced into new habitats fail to establish themselves. On the other hand, one species of *Achatina* from the east coast of Africa has been successful in colonizing Madagascar, Mauritius, Ceylon, Guam, and the Hawaiian Islands, and in the last-named locality only the most stringent methods of control have succeeded in keeping it from becoming a pest. The researches of the author indicate (as one would naturally suppose) that the species of *Achatina* outnumber those of *Strophocheilus* just as the genera of the Achatinidae outnumber those of the Strophocheilidae.

The book has 81 beautifully executed plates and a taxonomic index of 8 pages.

JOSHUA L. BAILY, JR.

A BOOK OF SPIDERS.

By W. S. Bristowe. Penguin Books, Harmondsworth, Middlesex; New York; Baltimore. 75 cents. 24 pp.; ill. 1947.

Not many of us will take a spider in a glass of claret, as did an early professor at Aberdeen—the fool died for his trouble—but as an animal of unique structures, habits, and tastes, the spider is not without its fascination as an object for biological study. It has not become a good subject for experimental research so that the group as a whole is known intimately only by a few taxonomists, but the author conveys something of their attraction for him in this small volume which he has had illustrated with a number of early but unpublished prints of British spiders. Personally, I cannot resist stepping on them, an act one can practice at will, since the author estimates that an acre of temperate zone grassland has a population of approximately two and a half million individuals.

C. P. SWANSON

THE SPIDER GENUS TMARUS (THOMISIDAE) IN PANAMA. *Bull. Mus. comp. Zoöl., Harvard Coll., Vol. 103, No. 4. By Arthur M. Chickering. The Museum of Comparative Zoölogy at Harvard College, Cambridge, Mass.* $1.25 (paper). Pp. 213–255; 4 pl. 1950.

This is another in a series of papers dealing with the spider fauna of Panama. As in the previous work the greater part of the material studied here was collected by the author himself. The work is entirely of a taxonomic nature. There is a very brief diagnosis of the genus, but no discussion of the relationships with other crab spiders. Since for most of the couplets contrasting characters are not supplied, the analytical key to species will have limited usefulness, and might well have been omitted. All the characters used in the key concern the genitalia of these animals, so that workers using this paper will undoubtedly prefer to compare their specimens with the illustrations supplied. A total of 18 species is included, of which 11 are indicated as new to science. For the latter the author supplies exceptionally detailed descriptions and good figures.

B. J. KASTON

GUIDE TO BRITISH INSECTS. *An Aid to Identification. By B. D. Moreton. Macmillan & Co., London.* 8s. 6d. viii + 188 pp.; ill. 1950.

This small handbook attempts to show how to place any British insect, whether young or adult, into its proper order (Diptera, Hemiptera, etc.), and in addition to indicate what books must be consulted if one wishes to find the name of any specific insect. The *Guide* differs therefore from the usual handbook which attempts to give the names of all the common insects in a geographic area. This innovation seems very creditable, since the kinds of insects are so numerous that no handbook could describe them all (there are 21,000 different kinds in Great Britain alone). Following a general introduction, there is a list of insect orders and another on the structure and life history of insects before the heart of the book is reached, the key to the orders. This key appears to be excellently arranged for the identification of immature forms as well as adults. The next 2 chapters provide full descriptions of each order, and lists books for more detailed study. The *Guide* is provided with a glossary of technical terms. A well illustrated handbook, this little volume will do the work of many a larger book devoted to much the same field and probably do it better.

W. HOVANITZ

ATLAS OF THE SCALE INSECTS OF NORTH AMERICA. *Volume V. By Gordon Floyd Ferris. Stanford University Press, Stanford, Cal.* $7.50. viii + 278 pp.; ill. 1950.

Volume 4 of this greatly needed work appeared in 1942 and closed with the disheartening prophecy that, although the author stood ready to devote the 10 or so years necessary to complete it, the *Atlas* would probably be discontinued due to the cost of publication. "If the world wants this Atlas . . . completed, the world must find some way to pay for it." In view of the great biological interest and economic importance of the coccids, all biologists must rejoice that this challenge has been met. For only through such painstaking comparative morphological studies as this, when eventually integrated with data on life histories, habits, hosts, distribution, cytogenetics, and symbionts, can an evolutionarily significant taxonomy of the Coccoïdea emerge.

Ferris makes clear why no really satisfactory system of classification is now possible. Relatively few of the existing species are yet known; and in only a small percentage of these has the male, which alone retains the imaginal stage and may hence be expected to yield key characters, been studied or even discovered. Present classification is thus based solely on the female, and since coccid evolution has progressed so largely through loss of parts, must depend on critical appraisal of the totality of minute characters which remain in that sex. Ferris accordingly holds it premature to consider the interrelationships of the higher categories. His *Atlas* is primarily for the identification of species, and comprises admirably detailed, large-scale drawings of the external anatomy of the female of each form considered, accompanied by a minimum of critical notes on synonyms, hosts, distribution, and recognition characters. The problem of genera cannot, of course, be avoided. Here Ferris steers a middle course, recognizing the non-systematist's interest in a stable nomenclature whenever no vital scientific issue is involved. Unfortunately, the economically and cytologically famous genus *Pseudococcus* cannot be preserved in its entirety: *P. citri* is now *Planococcus citri* (Risso), and *P. nipae* becomes *Nipaecoccus nipae* (Maskell). Ferris recognizes 11 families which have, with one or two exceptions, gained a fairly general acceptance.

Preceding series of the *Atlas*—usually bound as Vols. 1 to 4—have covered the family Diaspididae. Volume 5 includes about half of the family Pseudococcidae, and initiates the valuable features of a critical evaluation of family characters, and a partial key to the genera; the latter is to be replaced by a definitive key when the study of the family is completed. The loose-leaf format of earlier series has fortunately been abandoned, but there remains to plague the user a legacy in the chaotic arrangement of material in the work as a whole. Since the sequence of publication of the various units was of necessity determined on other than taxonomic grounds, the species of a given genus are sometimes to be found scattered in several volumes,

even including those yet to come. The lack of an index for each volume thus becomes a major defect. The table of contents is no adequate substitute; for instance, to find the present status of a species whose generic reference has been changed it may be necessary to check the synonyms throughout the entire family.

The *Atlas* is primarily a tool for the systematist. It cannot be expected to fill the crying need of the general biologist (1) for usable keys for the group as a whole, and (2) for some guide to the actual appearance of the insects in life, which bears so little resemblance to the dried material and microscopic mounts of cleared skins which constitute the museum collections. Balachowsky's monographic revision of the coccids of Europe, North Africa, and the Mediterranean basin, the first 5 volumes of which have already appeared, attempts the first of these objectives. His discussion of morphology, reproduction, and development in the group as a whole will give the non-specialist the background necessary for the use of Ferris' *Atlas*.

SALLY HUGHES-SCHRADER

LA BIOLOGIE DES LÉPIDOPTÈRES. *Encyclopédie Entomologique, Sér. A, XXIII.*

By P. Portier. Paul Lechevalier, Paris. 3,300 fr. (paper). 643 pp.; ill. 1949.

It would indeed be a herculean task to compose a volume which covered exhaustively all aspects of the biology of an order as large as the Lepidoptera. The present work, in 40 chapters comprising 643 pages, comes close to touching upon every aspect of this vast field. Therein lies its principal weakness. In attempting to approach a state of all-inclusiveness it sacrifices a conciseness and succinctness which would enhance the value of a treatise of this sort. There is a tendency to emphasize points which are relatively minor at the expense of topics which, at least in my opinion, deserve a fuller treatment. This tendency frequently expresses itself in the form of extended discussions of the author's own work without a proportionate consideration of the contributions of others. Consequently a reader who is unfamiliar with such sections of the field would receive a distorted impression of the accomplishments in that area. For example, under the heading of Olfactory Organs from the Morphological Point of View the author describes a tracheal trunk in the antenna and dwells at some length on the question of whether or not the trachea is open to the air distally. He advances a working hypothesis which states in essence that air entering the thoracic spiracles eventually traverses the antennal tracheal trunk and carries olfactory stimuli to the antennal sensilla. Moreover, many of the experiments described are not critical, and the conclusions are not always warranted (an example is the necessity of unimpaired circulation in the wings for effective flight, pp. 417–418). In addition, the book is based on older work to the neglect of more recent significant contributions, even though the bibliography includes a few references dated 1948 and 1949. Thus the treatise tends toward superficiality and imparts an erroneous impression of present-day knowledge of the biology of the Lepidoptera.

On the other hand, the work contains a tremendous amount of factual information of value and is quite effective when describing various ecological relationships and details of life histories. It is profusely illustrated with instructive drawings, diagrams, and photographs. This is one of its strong features. In short, this volume possesses considerable value as a reference work but should be read critically.

V. G. DETHIER

THE BUTTERFLIES OF SOUTHERN AFRICA. *Part I. Papilionidae and Pieridae. Transvaal Museum Memoir No. 3.*

By G. Van Son. Transvaal Museum, Pretoria, South Africa. £2. 2s. 0d. vi + 237 pp. + 41 pl.; text ill. 1949.

This volume, the first part of a taxonomic, morphological, and faunistic review of the Southern African butterflies, treats of the families Papilionidae and Pieridae. After presenting a key to the families and subfamilies, the author discusses the general characteristics, including those of the immature stages, of the Papilionidae. This is followed by a résumé of the adult characters, early stages, food plants, and distribution of *Papilio*, the only genus represented in Southern Africa. A key to the species of *Papilio* is then given, after which each species is described in turn. These descriptions consider, in addition to taxonomic characters, the life history, food plants, habits, distribution, and, frequently, notes on the specimens examined, male and female genitalia, and aberrations. Varietal forms within each species are described in such detail as current information permits. The author comments on the large number of such varietal forms in this geographical area and accepts all varietal names subject to rules of priority, synonymy, and homonymy. His stand is set forth in the Foreword. The plan of treatment of the Pieridae is similar. The book is well illustrated with numerous drawings of genitalia, excellent line drawings of many of the immature stages, 27 halftone plates depicting details of eggs, larvae, and pupae, and black-and-white photographs of adults. Unfortunately, the reproduction of the halftones is not so fine as might be expected in a volume that is otherwise technically excellent. Reproductions of the photographs are somewhat better. It is to be hoped that the author's desire to provide at some future date color plates in place of photographs may be fulfilled. For those persons interested in the butterflies of Southern Africa this volume fills a very great need, because

previous works covering this area are out of date and not easily obtainable.

V. G. DETHIER

SOME BRITISH BEETLES.

By Geoffrey Taylor; colour plates by Vere Temple. Penguin Books, Harmondsworth, Middlesex; Baltimore. 75 cents. 24 pp.; ill. 1948.

This little book presents colored plates by Vere Temple of some of the most common British beetles, usually with their immature stages. In the text life histories are given in a chatty manner. The book is intended for the general public and gives a readable introduction to the very varied habits of the beetles. Although it deals only with British beetles, all of the species treated have very close relatives in the United States. In many cases the difference between the British and American species is so slight that the figures might represent either, and this is also true for the life histories. The figure of the Lady Beetle labelled *Coccinella 5-punctata* has clearly seven spots and is, therefore, the common *Coccinnella 7-punctata*.

G. H. DIEKE

A REVIEW OF THE NORTH AMERICAN LANGURIIDAE. *Bull. Amer. Mus. nat. Hist., Vol. 92: Art. 3.*

By Patricia Vaurie. American Museum of Natural History, New York. 50 cents (paper). iv + Pp. 123–155; ill. 1948.

The Languriidae form a relatively small family of beetles which is represented in North America (United States and Canada) by the 4 genera *Languria* Latreille (14 species), *Dasydactylus* Gorham (1 species), *Acropteroxys* Gorham (2 species), and *Languriles* Motschulsky (1 species). Formerly the Languriidae were regarded as part of the Erotylidae, but are now more generally considered as a separate family in the superfamily Cucujoida. The monograph by Patricia Vaurie gives a revision of the North American species, which was badly needed, as no general account had appeared since 1873. A number of new species have been described in the meantime, and the general knowledge of the morphology and biology of the family had increased considerably. The paper contains keys to the genera and species and detailed descriptions as well as notes on distribution, the season when adults occur, and on the feeding habits of adults and larvae. The type locality is given in each case, but no attempt has been made to trace the present whereabouts of the types. It is not always quite clear on what basis the author regards a name as valid or as a synonym. The monograph, which has a selected bibliography, is a very useful collection of the available information on the Languriidae and should enable the collector to identify his specimens of this family.

G. H. DIEKE

THE WASPS OF THE GENUS SOLIERELLA IN CALIFORNIA (HYMENOPTERA, SPHECIDAE, LARRINAE). *Proc. Calif. Acad. Sci., 4th Ser., Vol. XXVI, No. 11.*

By Francis X. Williams. The California Academy of Sciences, San Francisco. $1.25 (paper). Pp. 355–417; 11 pl.; text ill. 1950.

Williams discovered, among some 600 California specimens of larrid wasps of the genus *Solierella* (inclusive of *Silaon* and *Niteliopsis*), fully 23 recognizable species of which 15 are here described for the first time. This is a very sizeable contribution to the fauna, for prior to Williams' research only 3 species of *Solierella* had been recognized from California.

Following a description of the genus and its natural subgroups, there is a key to the Californian species, and thereafter a listing ad seriatim of the species with detailed descriptive and distributional notes. Many of the more difficult characters are very nicely illustrated in the nearly 200 figures and, typical of F. X. Williams' works, there is an interesting account of what is known of the biology of the wasps concerned. Needless to say, most of what is now known of these obscure but wonderful wasps is owing to F. X. Williams' keen eye.

KENNETH W. COOPER

A MONOGRAPH OF THE EXISTING CRINOIDS. *Volume 1—The Comatulids. Part 4c.—Superfamily Tropiometrida (the Families Thalassometridae and Charitometridae). U. S. natl. Mus., Bull. 82.*

By Austin Hobart Clark. Smithsonian Institution, Washington, D. C. $2.25 (paper). viii + 370 pp. + 32 pl. 1950.

This large volume continues the systematic account of the existing comatulids or unstalked crinoids and comprises the 2 remaining of the 6 families of the Tropiometrida. Like the preceding volumes of the series, the work is indispensable to the student of echinoderms.

L. H. HYMAN

ECHINOIDEA. *B. A. N. Z. Antarctic Research Expedition 1929–1931 under the command of Sir Douglas Mawson. Reports—Series B (Zoology and Botany). Vol. IV, Part 10.*

By Th. Mortensen. Published by the B. A. N. Z. A. R. Expedition Committee and issued through the Barr Smith Library, University of Adelaide, Adelaide, Australia. 8s. (paper). Pp. 287–310 + 6 pl.; text ill. 1950.

The echinoids of the expedition consisted of 29 species, 13 of which are cidarids, a group known to be richly represented in the Antarctic, often by specimens of

large size. Most antarctic echinoderms are viviparous or brood-protecting, and this was found to be true for *Ctenocidaris perrieri* and *geliberti*, and also *Plexechinus nordenskjöldi* in the present material. Four new species are described, among which *Notocidaris remiger* is notable for its extraordinarily broad spines, somewhat oar-shaped.

L. H. HYMAN

PELAGIC TUNICATES OF AUSTRALIA.

By Harold Thompson. Commonwealth Council for Scientific and Industrial Research, Melbourne, Australia. Free upon request. 196 pp. + 75 pl. 1948.

This is primarily a handbook for the identification of pelagic tunicates, designed for use in oceanographical research in southern waters. Only circumtropical and subtropical species are included, since subantarctic forms do not reach even the relatively cold Tasmanian region. Next to crustaceans the tunicates comprise the chief portion of the zooplankton in Australian waters, and as biological indicators of oceanographic conditions they may well be superior. Taxonomic and ecological descriptions are given for 23 appendicularians and 22 thaliaceans, with excellent illustrations for all forms, together with a good identification key. There is a brief but excellent general discussion of the biology and ecology of the pelagic tunicates in relation to southeastern Australian waters. The bibliography is inclusive.

N. J. BERRILL

NEW AND LITTLE KNOWN CARTILAGINOUS FISHES FROM THE ATLANTIC. *Bulletin of the Museum of Comparative Zoölogy at Harvard College, Vol. 103, No. 7.*

By Henry B. Bigelow and William C. Schroeder. The Museum of Comparative Zoölogy, Harvard College, Cambridge, Mass. $1.00 (paper). Pp. 385–408 + 7 pl. June, 1950.

Five new species of *Breviraja* and 2 new deep water species of *Raja* are described and figured. A revision of the holocephalan family Rhinochimaeridae recognizes a new genus, *Neoharriotta*.

BRITISH REPTILES AND AMPHIBIA.

By Malcolm Smith; illustrated by Paxton Chadwick. Penguin Books, Harmondsworth, Middlesex; Baltimore. 75 cents. 16 pp.; ill. 1949.

This is a delightful and charming little book written by one of the world's foremost herpetologists for British laymen. These laymen are presumably mature and receptive, for the book is written without condescension and, although the language is informal, it is decidedly adult. It is an excellent little summary of the reptiles and amphibians inhabiting the British Isles. The Europeans, with commendable frequency, produce scholarly reviews of a subject matter area for persons who are non-specialists in so far as the material of the review is concerned. This is a very desirable state of affairs, and one often wishes that outstanding American experts would increase the rate of similar contributions to the modern literature.

Some pages of general information comprise a thumb-nail sketch of the biology of amphibians and reptiles, especially of the British forms. For one interesting idea suggested, namely, that ovoviviparity is an adaptation for living in colder climates, the reviewer is unaware of any rigorous presentation based on either observational or experimental data.

After the general section there follows a statement about each of the British species, accompanied by a colored plate. The fauna consists of 3 salamanders (all in the genus *Triturus*), 2 toads (*Bufo*), 3 frogs (*Rana*, 2 of which are introduced forms), 3 lizards (*Anguis* and *Lacerta*), and 3 snakes, one of which is poisonous.

ARNOLD B. GROBMAN

AN ANNOTATED CHECKLIST AND KEY TO THE REPTILES OF MEXICO EXCLUSIVE OF THE SNAKES. *U. S. natl. Mus., Bull. 199.*

By Hobart M. Smith and Edward H. Taylor. Smithsonian Institution, Washington, D. C. 75 cents (paper). vi + 253 pp. 1950.

This completes the checklist survey of 1165 forms of Mexican amphibians and reptiles by these authors. The style and arrangement of the present volume is similar to that of its earlier companion volumes: on snakes (*Q. R. B.*, 21: 93. 1946) and on amphibians (*Q. R. B.*, 23: 359. 1948). In any work of this nature minor errors are unavoidable. For example, the key to the subclasses, orders, and suborders of reptiles (p. 12) is unworkable as it is impossible to get to couplets 3 and 4. Errors of this nature will only be negligible irritations when it is realized how tremendously useful this set of Checklists will be. These 3 volumes are a necessity for anyone professing to have even the most modest library on Mexican herpetology.

ARNOLD B. GROBMAN

STUDIES OF THE BLACK SWAMP SNAKE, SEMINATRIX PYGAEA (COPE), WITH DESCRIPTIONS OF TWO NEW SUBSPECIES. *Misc. Pub., Mus. Zool., Univ. Mich., No. 76.*

By Herndon G. Dowling. University of Michigan Press, Ann Arbor. $1.25 (paper). 38 pp.; ill. 1950.

The Black Swamp Snake is a small, secretive, aquatic snake which has a known geographic range in the Coastal Plain from North Carolina through Florida. On the basis of a rather critical examination of a number of pattern and scutellation characters, Dowling proposes that 3 races be recognized. In addition to careful work on the taxonomy and variation of the species, the paper also includes considerable information regarding its life history. Almost half of the specimens available for study were collected by Dowling himself. This paper is to be recommended because it satisfactorily summarizes the biology of a monotypic genus, and further because of its somewhat wider appeal due to the incorporation of several unusual graphic devices for presenting data.

This quite favorable review could, I suspect, have been anticipated. The undersigned was a member of the Supervisory Committee that approved Dowling's M.A. thesis. The publication reviewed is essentially that thesis in published form.

ARNOLD B. GROBMAN

TRAITÉ DE ZOOLOGIE—*Anatomie, Systématique, Biologie. Tome XV—Oiseaux.*

By J. Benoit, J. Berlioz, F. Bourlière, P.-P. Grassé, E. Letard, R. Matthey, N. Mayaud, E. Œhmichen, J. Pasteels, J. Piveteau, A. Portmann, A. Rochon-Duvigneaud. Published under the direction of M. Pierre-P. Grassé. Masson et Cie., Paris; (Walter J. Johnson, New York). 6000 fr.; $18.00. 1164 pp. + 3 pl.; ill. 1950.

The present volume of this monumental zoological treatise is one of 17 proposed numbers edited under the direction of Pierre Grassé. To date 4 volumes have appeared and 3 more are soon to be ready. Each volume is the cooperative effort of many collaborators. The topics considered and their respective authors are as follows: skin, feathers, plumage, molt, pigmentation, longevity, biology of reproduction, nutrition, voice and sounds, and social life (N. Mayaud); skeleton, nervous system, sense organs, circulatory and respiratory organs, digestive system, body temperature and homoiothermy, and postembryonic development (A. Portmann); musculature, flight terrestrial and aquatic locomotion (E. Œhmichen); eyes and vision (A. Rochon-Duvigneaud); uropygial gland and social organization (P.-P. Grassé); endocrine glands, urogenital system, reproduction and the sexual cycle (J. Benoit); avian chromosomes (R. Matthey); embryonic development (J. Pasteels); ecology and physiology of migration (F. Bourlière); origin and evolution (J. Piveteau); speciation, recently extinct species, systematics, geographic distribution, general features, and origins of migration (J. Berlioz); and the origin of domestic birds (E. Letard). The order in which these topics is presented is naturally not as given above but begins with the external anatomy, followed by the internal anatomy, endocrinology, physiology of reproduction, embryology, biology of reproduction, nutrition, social life, ecology, systematics, and migration.

The presentation of the material by the various authors is clear and straightforward. As one might expect in such a large undertaking, a question can be raised regarding relative emphasis. Thus, the physiology of reproduction covers 94 pages, whereas ecology includes only 34. The chapters on the skeleton and musculature are likewise brief, but these topics have been covered in great detail in other books. On the other hand, compared to previous large treatises on birds (by Gadow, Brehm, Groebbels, Stresemann, and others) the total coverage is more uniform, with less emphasis and detail on particular phases. A better balanced presentation of ornithological knowledge is the result. Within this admirable selection there are minor tendencies toward conciseness or elaboration. Generally speaking, debatable subjects are discussed in such a way that one gathers that the problem is still open; thus, anting, homing ability, origin of birds, to mention a few at random, are presented in nonpartisan fashion.

Complete bibliographies would be out of the question, so only the major, pertinent references have been included. These are inserted at the end of each topic. It is a surprise to note that some are as recent as 1949. There are numerous illustrations, including 3 color plates, and many tables and graphs, as well as a subject index.

That considerable cooperation has existed in this undertaking is evident from the fact that very little repetition of subject matter occurs and that cross references are numerous. An exception: Portmann (p. 82) states that the avian clavicles are not homologous to those of the mammals, while Piveteau (p. 809) believes they are. Probably other discrepancies occur but just as likely they are minor or of a debatable nature. Less care, however, has been directed to the references. Citations of journals are apt to differ among different authors (nor is the same one necessarily consistent), different abbreviations being used, page references being given or omitted, etc. With regard to English titles, the French seem to have been influenced by German language customs; in the titles, words are capitalized here and there at random with odd results, the abbreviation a. for and was noted, Schoemaker for Shoemaker, etc. Nomenclature, which is an important feature in a book that discusses so many different organisms, seems to have fared reasonably well, the scientific names being consistent and up to date. An erratum at the end of the book takes care of certain mistakes. In the systematic section, which takes up the birds family by family, Berlioz still insists on capitalizing some specific names. The Coraciiformes are here called the Coraciadiformes. The families of the Passeriformes are arranged in a sequence

different from that adopted by the American Ornithologists' Union.

If this review expresses traces of enthusiasm, it was meant that way. Ornithologists will welcome this useful, informative book which has brought together so many of the multifold aspects of bird study within a reasonable scope. It is up to date, easy to comprehend, and authoritative. As the movie critics would put it, it deserves 5 stars.

HENRI C. SEIBERT

GRØNLANDS FUGLE. *The Birds of Greenland. Part II* *By Finn Salomonsen; plates by Gitz-Johansen. Ejnar Munksgaard, Copenhagen.* $9.00 (paper). Pp. 159–348; ill. 1951.

The second part of Finn Salomonsen's *Birds of Greenland* has now been published, in the same luxurious quarto format, with 17 beautifully reproduced colored plates by Gitz-Johansen. It covers the only game bird of that desolate country; the waders, consisting of 2 plovers, 1 turnstone, the whimbrel, 6 sandpipers, and 2 phalaropes; a number of skuas and gulls, and 1 tern. The text, in Danish and in English, is excellent. As before, Salomonsen has gathered, both first-hand and from other workers and observers, a mass of material on the history, distribution, geographical variation, and habits of the birds, and he presents it in a clear and orderly way. As to the illustrations, the writer is sorry to confirm his previous opinion that Gitz-Johansen is not a bird artist. The awkward and clumsy pictures of his waders and gulls are even more remote from reality than are those of the waterfowls in the first volume. He obviously has little understanding of the shape, postures, and actions of birds. It is all the more regrettable that his vigorous and interesting treatment of the backgrounds shows he is clearly a painter of talent.

J. DELACOUR

BIRDS OF THE WEST. *New Edition.* *By Ernest Sheldon Booth; illustrated by Harry Baerg and Carl Petterson. Stanford University Press, Stanford, California.* $6.00. xii + 402 pp. + 8 pl.; text ill. 1950.

A bird guide of convenient carrying size designed primarily for beginners who wish to identify Western birds. The book uses a system of identification based upon keys, a system which the author states is a relatively new innovation in the field identification of birds. This system has apparently been used to advantage by the author's own students and is one to be considered by the interested beginner. While the book has several good color plates of various birds, the black-and-white pictures are not reproduced to best advantage, appearing lifeless and somewhat distorted in several instances. They still, however, should serve their main function, that of aiding in the identification of the bird portrayed. The descriptions of some birds, such as the horned lark and screech owl, are accompanied by maps and listings of the ranges of the various subspecies within the species, a point that seems somewhat advanced for the beginner. A useful appendix describes briefly methods of attracting and photographing birds, discusses bird nests, and presents an introduction to ornithological literature.

JOHN CUSHING

THE INDOOR BIRD WATCHER'S MANUAL. *By Helen Ferril; illustrated by Anne Folsom. Duell, Sloan and Pearce, New York.* $1.00. 64 pp. 1950.

This manual is clearly modeled after the outstanding manuals of Roger Tory Peterson for the identification of birds in the field. Emphasis is placed in the drawings upon outline and silhouette rather than upon detail or color. The text is not equal to the need for clear characterization. While the descriptions are succinct, prominent characteristics of one or another species are omitted. The efforts to describe the calls of the 46 chosen birds are frequently sufficiently ludicrous to raise a smile rather than to aid in identification. However, the drawings are probably enough for quick and accurate classification. Some of the better descriptions are those of the Red-eyed Bleerio, the Ruffled Spouse, the Scarlet Teenager, the Nature Plover, the Bright-eyed Gawk, the Great Bald Ego, the Duckbilled Platitude, and the Extra-marital Lark.

PERCY THE OFFICE BOY

DISTRIBUTION AND ORIGIN OF THE BIRDS OF MEXICO. *Bull. Mus. comp. Zool., Harvard Coll., Vol. 103, No. 6. By Ludlow Griscom. Museum of Comparative Zoology, Harvard College, Cambridge, Mass.* 75 cents (paper). Pp. 339–382. 1950.

The writer has outlined the principal features which govern the distribution of birds in Mexico, and has attempted to explain the probable origins of the various bird faunas. It is pointed out that the classical Neotropical and Nearctic faunal regions have little meaning. Somewhat more akin to the facts would be to recognize six "regions," as follows: Boreal (Holarctic), Middle North American, Warm North American, Equatorial South American, Andean South American, and Temperate South American. On the basis of this grouping, the Warm North American (Sonoran) endemics constitute 34 per cent of the Mexican avifauna. In the humid tropical forests of southeastern Mexico, the bird life exhibits South American relationships which become more marked as one proceeds south-

ward. Endemism in this element is nil. Other Mexican birds are typically Middle North American and Boreal in affinity, hence the absurdity in attempting to classify Mexico as either Nearctic or Neotropical. The writer believes that the mild temperatures of the Ice Ages initiated southward migrations among many groups of Old Northern families and genera, passing through Mexico and leaving some members behind. From this migration there originated many present day endemic genera and species. During the maximum period of cold, the South American element was destroyed in Mexico and replaced by a modern Boreal element, which penetrated beyond into South America. Since the retreat of the ice, many South American forms are recapturing former ground, little evolutionary change having occurred in them; instead, Mexico has been an evolutionary center for many North American families and genera. It must be remembered that Mexico has an extremely abundant and varied avifauna which renders any zoogeographical interpretations rather difficult. Since Griscom has had considerable experience with the birds of this area, his ideas and conclusions merit careful consideration.

HENRI C. SEIBERT

THE HAWAIIAN HONEYCREEPERS (AVES, DREPANIDAE). *Bull. Amer. Mus. nat. Hist., Vol. 95, Art. 4.* *By Dean Amadon. American Museum of Natural History New York.* $1.75 (paper). Pp. 151-262 + 7 pl.; text ill. 1950.

The Hawaiian honeycreepers are a curious assemblage of birds limited to the Hawaiian Archipelago. Of primary biological interest is their surprisingly great diversity in external structure, especially that of the bill, so much so that they have been often cited as a prime example of divergent adaptation. This extreme variability in form is expressed in the fact that practically every species described was considered monotypic. The present review takes a broader attitude. Only 9 genera are recognized, although 5 of these are monotypic. The family itself is rather ill-defined (like most bird families) and its relationships to other groups are not certain, although in this work the Coerebidae are favored as nearest relatives.

This diversity of forms on a group of islands is especially well suited for a study in speciation. Differentiation has occurred in geographically isolated populations. Some species have straggled between islands more than others, and consequently the degree of differentiation is not so great among them. Endemism is most pronounced on the more isolated islands. The larger islands, having a more varied ecology, have a richer (more varied) avifauna, apparently because many species are able to survive by utilizing ecological niches absent on the smaller islands. Intraspecies competition has placed a premium upon divergence, and adaptive radiation has filled in the empty ecological spaces, when present. Intermediate adaptive changes are beautifully illustrated in the genus *Hemignathus*, one species of which has a bill intermediate between the extremes, while the bird's method of feeding is similarly intermediate.

Aside from the problem of speciation, much information is given regarding plumage and molt, comparative anatomy and other anatomical details useful for phylogenetic analysis (although it has already been pointed out that these do not provide much help), biometrics of size, and some notes on general life history, especially the feeding habits which are so intimately correlated with the shape of the bill. Many species of the family are now extinct, and others are extremely rare. The primary cause for this reduction is attributed to parasites and disease, but it seems that destruction and alteration of the original habitat would be more dangerous to the continued existence of such highly adapted forms and that diseases would play a secondary role.

HENRI C. SEIBERT

NEW ILLUSTRATIONS OF THE BIRDS OF JAPAN. *Limited Edition.* *By Seinosuke Uchida; plates by Shigezo Kobayashi. Sogen-sha Publishing Co., Tokyo; American distributor: Charles E. Tuttle Co., Rutland, Vermont.* $10.00. 313 pp.; ill. 1949.

Complete and adequate illustrations of the birds of any country always prove useful to naturalists the world over. They also very considerably increase interest inside that country. The general public becomes aware of the beauty, usefulness, and value of the avifauna, and is better disposed towards it. In the present days of wanton destruction of life, this is an important point. The *New Illustrations of the Birds of Japan* no doubt answer these various needs. All birds are figured in color, 6 on each plate. The pictures are satisfactory and suitable for the purpose, as also the reproduction. It is not an art book, of course, but a perfectly good and useful work, which will render excellent services. The text of S. Uchida is no doubt adequate, but as the Latin names of birds are the only words printed in our alphabet, it is difficult for the reviewer to appreciate it. His almost complete ignorance of oriental characters does not allow him to form a sensible opinion. There are several pages of generalities on birds and a short note on every form.

This book will certainly serve a useful purpose in Japan, while all ornithologists will be happy to possess such a complete and satisfactory representation of the birds of that country.

J. DELACOUR

NOTES ON A COLLECTION OF BIRDS FROM BATAAN, LUZON, PHILIPPINE ISLANDS. *Bull. Amer. Mus. Nat. Hist., Vol. 94, Art. 8.*

By E. Thomas Gilliard. The American Museum of Natural History, New York. 60 cents (paper). Pp. 457–504; ill. 1950.

As a result of the damage wrought in the Philippines during World War II, the bird collections at the National Museum of the Philippines were destroyed. Since many topotypical specimens were housed in this collection, its loss was a serious blow to bird taxonomists. One purpose of the collecting trip reported in this bulletin was to provide the National Museum and the American Museum of Natural History with some of these critical specimens. In addition to the systematic list of the specimens collected, which forms the major portion of this report, there are useful introductory notes on the geology, climatology, zoogeography, and plant communities of the region. The Ijima Willow Warbler is recorded as a new member of the Philippine avifauna, and one new race of sunbird is described.

HENRI C. SEIBERT

BIRDS OF THE COAST.

By C. A. Gibson-Hill; illustrated by the author. H. F. & G. Witherby, London. 10s. 6d. xxxii + 216 pp. + 16 pl.; text ill. 1949.

Here is an excellent book for any ornithologist doing field work along the British coast. It is specifically intended to help in identification, to accomplish which purpose the birds are carefully described with special reference to characteristic field marks. Comparisons are made to similar species, and methods of separating one from the other by song, habits, distribution, or plumage (at all seasons) are given in detail in the text. Coastal birds, as here defined, are those birds actually found on or near the coast, and so include such species as the crows, pipits, swallows, and birds of prey, as well as those birds limited to a marine environment. The introduction, although short, is packed with valuable information. Breeding data are included as an appendix. Many black and white drawings depict those salient characters mentioned in the text as useful for identification. Distribution maps are provided for certain species. Only testing in the field will reveal whatever shortcomings may exist in this guide, but it appears to be one of the better bird manuals.

HENRI C. SEIBERT

BREEDING AND OTHER NOTES FROM NYASALAND AND THE LUNDAZI DISTRICT OF NORTHERN RHODESIA. *Bull. Mus. comp. Zoöl., Harvard Coll., Vol. 106, No. 2.*

By C. W. Benson. Museum of Comparative Zoölogy, Harvard College, Cambridge, Mass. $1.00 (paper). Pp. 69–114. June, 1951.

Breeding records of *birds*, with descriptions of the nests and eggs of some little known forms and with distribution records of interest to students of African ornithology.

CONTRIBUTIONS TO THE BIOLOGY OF THE PHILIPPINE ARCHIPELAGO AND ADJACENT REGIONS. *Copepods Gathered by the U. S. Fisheries Steamer "Albatross" from 1887 to 1909, Chiefly in the Pacific Ocean. U. S. natl. Mus., Bull. 100, Vol. 14, Part 4.*

By Charles Branch Wilson. Smithsonian Institution, Washington, D. C. $1.00 (paper). x + Pp. 141–441 + 35 pl. 1950.

AN ILLUSTRATED GUIDE TO THE FRESHWATER FISHES OF THE SUDAN.

By H. Sandon; coloured illustrations by Mrs. J. M. Stubbs. Sudan Notes and Records, Khartoum. Free upon request (paper). 61 pp. + 14 pl. 1950.

A KEY TO SOME SOUTHERN CALIFORNIA FISHES BASED ON VERTEBRAL CHARACTERS. *Fish. Bull. No. 79.*

By Charles R. Clothier. State of California, Department of Natural Resources, Division of Fish and Game, Bureau of Marine Fisheries, Terminal Island, Cal. Free upon request (paper). 83 pp.; ill. 1950.

ECONOMIC ZOOLOGY

ANIMAL SCIENCE.

By M. E. Ensminger. The Interstate, Danville, Ill. $6.00. 1059 pp.; ill. 1950.

This book is intended for 4-H and FFA members, college students, farmers, and ranchers. Elementary information on the breeding, feeding, and management of beef cattle, sheep and goats, swine, and horses and mules is presented in simple language.

Geographic distribution and historical changes in the livestock industry are reviewed in brief, interesting fashion. The marketing and processing of livestock and their products are described historically and currently. Appendices include a gestation table, a list of breed record associations and breed publications.

Though omnibus in nature, the book is written concisely with a minimum of argument. Errors are infrequent but include a statement of glycogen in blood (p. 105) when glucose was clearly meant and "specie" for species (p. 781). The book is a useful general textbook and reference.

T. C. BYERLY

SHEEP MANAGEMENT AND DISEASES. *Australian Agricultural and Livestock Series.*

By H. G. Belschner. Angus and Robertson, Sydney and London; [P. D. & Ione Perkins, South Pasadena, Cal.] $9.50. xii + 718 pp. + 3 pl.; text ill. 1950.

This book, written primarily for the agricultural college student and for the sheep producer of Australia, has no counterpart in the United States. The descriptions of breeds and types of sheep, and many of the methods of sheep husbandry apply chiefly to the sheep-producing areas of the southern hemisphere. Nearly 50 pages are devoted to blowfly strike. Illustrations of the flies which are involved, their life histories and habits, control and treatment are dealt with. Breeding, feeding, the care of sheep, and the handling of the wool clip are discussed in separate chapters.

The second part of the book contains 13 chapters on the diseases of sheep. This is the most complete contemporary treatise on sheep diseases in the English language. Although in some instances the diseases or conditions described do not occur in North America, by and large the information has world-wide application. The anatomy and physiology of sheep, the technique of the post-mortem examination, infectious and non-infectious diseases, parasitic diseases, diseases of the skin and wool, poisoning, and wounds and fractures are completely and authoritatively discussed. The text is well illustrated with charts, line drawings, black-and-white and color photographs.

FREDERICK N. ANDREWS

MODERN DAIRY GOATS. *Country Books, No. 2.*

By Mary Douglas Gordon. Nicholson & Watson, London. 6s. 180 pp. + 12 pl.; text ill. 1950.

This enthusiastically written book is all about goats. It was written primarily for those who know nothing about goats but who would be willing to risk life, limb, and reputation by keeping one in the garage or backyard.

The author asks and answers the questions. "Are you thinking of keeping a goat? Do you think it would be very nice to have your own milk, butter and cheese but fear the business of keeping a goat or two would be beyond you?—think again. Do not let yourself be fobbed off too easily with the idea that you could not manage it, for it is probably much easier than you think." The next 180 pages are devoted to telling the reader how to recognize and treat such problems as breeds of goats, housing, feeding, breeding, and milking goats, and how to make butter and cheese.

To the reader of the more sophisticated magazines who solves his dairy products problems by leaving a note for the milkman, such a treatise may seem amusing. To the thousands of families throughout the world who cannot afford or have no access to a regular milkman, the practical advice in this book may give them confidence to keep a goat or two.

FREDERICK N. ANDREWS

CANADA GEESE OF THE MISSISSIPPI FLYWAY *with Special Reference to an Illinois Flock. Bull. Ill. nat. Hist. Sur., Vol. 25, Art. 3.*

By Harold C. Hanson and Robert H. Smith. Illinois Natural History Survey, Urbana. Gratis (paper). Pp. 61–210; ill. 1950.

The Horseshoe Lake Game Refuge in southern Illinois was instituted in 1927 for use as a wildlife refuge. Since that time it has become a mecca for the Canada goose, which concentrates there during the non-breeding season. Not only was the refuge successful in attracting geese, but it also became host to a horde of hunters who literally surrounded the area during the hunting season. As a result the refuge became known as a slaughter pit, and increasing doubt was expressed as to its value. Fortunately a program of study was initiated that has culminated in this most valuable report. From trapping and banding studies, analysis of banding recoveries, including the mass of data accumulated at the Jack Miner Bird Sanctuary, bag inventories, trips to the breeding grounds, and other available sources of information, the writers have been able to arrive at some interesting and important information relative to goose management. It would be impossible to review the entire material presented but by way of illustrating the wealth of data, it may be said that there are 82 figures and 45 tables in 143 pages of text. Significantly, it was determined that geese do not breed until at least 2 years of age and that the annual kill at Horseshoe Lake was extremely heavy on the juveniles, to such an extent that the mortality was not being made up by the productivity of the remaining birds. These conclusions are supported by considerable evidence. Mortality by predators and Canadian Indians are not held responsible for the decline in the goose population but solely the terrific loss incurred by the killing and crippling at the refuge. A closed season followed by reduced bag limits seems to have materially aided the geese. A buffer area around the refuge was recently added and it now appears that the Mississippi goose population may be secure.

Aside from the problems of management, there is much in this report on the biology of geese in general. Of greatest interest is the discovery that the Hudson Bay-James Bay population of geese (*Branta canadensis interior*) is actually composed of four subpopulations, each having a fairly distinct breeding and wintering range of its own and each, therefore, constituting a separate management unit. Breeding sites, routes of migration, pairing, family relationships, and other

phases of the goose life history receive attention. This is a most valuable, indeed indispensable, report.

HENRI C. SEIBERT

TROPICAL FISHES *for a Private Aquarium. Revised Edition.*

By Christopher W. Coates; photographs by S. C. Dunton. Liveright Publishing Corp., New York. $2.95. xii + 258 pp. + 39 pl. 1950.

This is one of the better, less pretentious aquarium guides, essentially the same book as the edition of 1933. An Appendix is the principal addition, in which some of the more recent discoveries, both in aquarium maintenance and recently domesticated fishes, are briefly reviewed. If the author has heeded the advice of a reviewer of the former edition to mention that an aquarium of tropicals must be covered, he has buried it beyond notice.

J. W. HEDGPETH

NORTHWEST ANGLING.

By Enos Bradner. A. S. Barnes & Co., New York. $5.00. xii + 239 pp. + 2 pl.; text ill. 1950.

For the angler who lives in the Northwest, and especially for the outlander planning his first piscatorial visit to this region, Bradner's little volume is an excellent handbook. It contains practically everything the sportsman needs to know about the game fishes of the area. Several chapters are devoted to an atlas of steelhead streams in the Northwest states. There are less comprehensive but reasonably detailed identifications of the waters in which the cutthroat trout and the several varieties of salmon are to be found. Angling techniques and equipment for all species and all conditions of weather, water, and tide are discussed. Of special interest to the fly fisherman are the 2 color plates of artificial flies characteristic of the Northwestern states, together with adequate instructions for the man who ties his own.

P. STEWART MACAULAY

RESULTS OF ENCOURAGEMENT FOR THE DEVELOPMENT OF ALBACORE FISHING GROUNDS IN 1939. *Special sci. Rept., Fisheries No. 33.*

Translated from the Japanese by W. G. Van Campen. U. S. Department of the Interior, Fish and Wildlife Service, Washington, D. C. Paper. ii + 175 pp.; ill. 1950.

One result of the late World War was an extension of this country's interest in the cognizance and development of fisheries resources of the Pacific area. While the war was in progress a small initial task force of fishery biologists, primitively equipped but enthusiastic, was sent to accompany the fleet and examine the feasibility of supplementing the protein diet of our troops with fresh fish caught adjacent to operations. More recently an appreciable effort has been exerted by the Fish and Wildlife Service and other government agencies to extract every available piece of information concerning oriental fishery practices, production, problems, research, etc.

This report is a translation recording the results of a successful Japanese search for new albacore fishing grounds in the North Pacific area (163°E to 165°W, 30°N to 45°N) during the period from May 1 to October 31, 1939. Nine deep-sea fishery patrol vessels of 104.5 to 269.8 tons, equipped with longlines, trolling and pole fishing gear, refrigeration facilities, and oceanographic sampling equipment participated. The report itself is comprised largely of tabular material (temperatures, specific gravities, water color, transparency, atmospheric pressure, weather, length-weight frequencies, and catch data) along with brief written accounts of observations made during the voyage of each ship. Some difficulty was encountered by the translators in correctly reading some of the charted material which was made available to them in the form of microfilms.

The average biologist will find this publication of no great interest to him unless he happens to be a fishery biologist whose area of studies coincides with the material. The material has undoubtedly proven valuable, perhaps inspirational, in planning our own greatly augmented exploratory and developmental programs in the Pacific for tuna. Although the Japanese report lacks a critical and comprehensive summary (there is a summary of a sort), some interesting general conclusions that may be extracted by the reader are as follows: 1) mothership operation is desirable to save valuable running time over the vast distances involved; 2) the schools of fish move south in winter and north in summer between the Hawaiian islands and the Aleutians; 3) fish were more abundant at surface water temperatures between 16°C and 19°C; 4) the optimum water temperature changes somewhat with the season; 5) food for the fish is abundant in the North Central Pacific; 6) the fish varied least in size in large catches and at the center of the fishing grounds; conversely, there was greater size variation at the edges of the schools; 7) fishing was generally better during rough weather; and 8) the longline method is recommended over any other.

COIT M. COKER

TUNA FISHING IN PALAU WATERS. *Special sci. Rept., Fisheries No. 42.*

Translated from the Japanese language by SCAP translators and W. G. Van Campen; edited by B. M.

Shimada and W. G. Van Campen. Paper. 26 pp.; ill.

FISHING CONDITIONS SOUTH OF THE MARSHALL ISLANDS. *Special sci. Rept., Fisheries No. 43.*

Translated from the Japanese language by W. B. Van Campen. Paper. 23 pp.; ill.

TUNA BAIT RESOURCES AT SAIPAN. *Special sci. Rept., Fisheries No. 44.*

Translated from the Japanese language by W. G. Van Campen. Paper. 15 pp.

EXPLORATORY TUNA FISHING IN INDONESIAN WATERS. *Special sci. Rept., Fisheries No. 45.*

Translated from the Japanese language by SCAP translators and W. G. Van Campen; edited by B. M. Shimada and W. G. Van Campen. Paper. 17 pp.; ill.

EXPLORATORY TUNA FISHING IN THE CAROLINE ISLANDS. *Special sci. Rept., Fisheries No. 46.*

Translated from the Japanese language by W. G. Van Campen. Paper. 42 pp.; ill.

EXPLORATORY TUNA FISHING IN THE MARSHALL ISLANDS. *Special sci. Rept., Fisheries No. 47.*

Translated from the Japanese language by SCAP translators and W. G. Van Campen; edited by B. M. Shimada and W. G. Van Campen. Paper. 21 pp.; ill.

JAPANESE TUNA SURVEYS IN TROPICAL WATERS. *Special sci. Rep., Fisheries No. 48.*

Translated from the Japanese language by W. G. Van Campen. Paper. 40 pp.; ill.

THE JAPANESE SKIPJACK FISHERY. *Special sci. Rept., Fisheries No. 49.*

Translated from the Japanese language by W. G. Van Campen. Paper. 67 pp.; ill.

KISHINOUYE'S ORDER PLECOSTEI. *Special sci. Rept., Fisheries No. 50.*

Translated from the Japanese language by W. G. Van Campen. Paper. 16 pp.

JAPANESE SKIPJACK STUDIES. *Special sci. Rept., Fisheries No. 51.*

Translated from the Japanese language by W. G. Van Campen. Paper. 30 pp.; ill.

ON THE JAPANESE BLACK TUNA (*Thunnus Orientalis*). *Special sci. Rept., Fisheries No. 52.*

Translated from the Japanese language by W. G. Van Campen. Paper. 22 pp.; ill.

U. S. Department of the Interior, Fish and Wildlife Service, Washington, D. C. 1951.

This series of reports consists of translations of semi-technical articles and research papers from Japanese fisheries journals, most of them published in the last 10 years. Some of the reports include several articles, by various authors. It is unfortunate that these and other translations are issued in limited quantities "for official use of Federal, State or cooperating agencies." They should also be available to all interested students.

JOEL W. HEDGPETH

PLANKTON CHARACTERISTICS AT THE CRONULLA ONSHORE STATION, NEW SOUTH WALES *1943–46. Bull. No. 246 (Div. of Fisheries—Rep. No. 17), Commonw. sci. & indust. Res. Org., Australia.*

By Keith Sheard. Commonwealth Scientific and Industrial Research Organization, East Melbourne, Australia. Gratis (Paper). 23 pp. 1949.

NORTH AMERICAN FRESH WATER SPORT FISH. *Description & Habits, Fishing Tackle & Methods.*

By Lou S. Caine; scientific notes by Dr. Karl F. Lagler; foreword by J. Hammond Brown. A. S. Barnes & Co., New York. $5.00. xiv + 212 pp.; ill. 1949.

SALT-WATER FISHING. *A Complete Guide to Salt-Water Fishes and How to Catch Them.*

By Robert A. Dahne; illustrated by Elena K. Mead. Henry Holt & Co., New York. $5.00. xvi + 342 pp.; ill. 1950.

KEY TO THE FAMILIES OF COMMON COMMERCIAL FISHES IN THE PHILIPPINES. *Res. Rept. 21, Fish & Wildlife Serv., U. S. Dept. Interior.*

By Agustin F. Umali. U. S. Government Printing Office, Washington. 20 cents (paper). 47 pp.; ill. 1950.

AN ANNOTATED BIBLIOGRAPHY ON THE BIOLOGY OF PACIFIC TUNAS. *Fishery Bull. 58. From Fishery Bull. Fish & Wildlife Serv., Vol. 52.*

By Bell M. Shimada. U. S. Department of the Interior, Fish and Wildlife Service, Washington, D. C. 30 cents (paper). 1951.

THE COMMERCIAL FISH CATCH OF CALIFORNIA FOR THE YEARS *1948–1949, with Yield per Area of the California Sardine Fishing Grounds 1937–1949.*

By the Staff of the Bureau of Marine Fisheries. State of California, Department of Natural Resources, Division of Fish and Game, Bureau of Marine Fisheries, Terminal Island, Cal. Gratis (paper). 87 pp. + 1 folding chart. 1951.

DIET AND DENTAL DEVELOPMENT IN THE SHEEP. *Bull. 252, Common. sci. & indust. Res. Org., Australia.*

By M. C. Franklin. Commonwealth Scientific and Industrial Research Organization, Melbourne, Australia. Gratis (paper). 34 pp. + 23 pl. 1950.

ANIMAL GROWTH AND DEVELOPMENT

CHEMICAL EMBRYOLOGY.

By Jean Brachet; translated from the French by Lester G. Barth. Interscience Publishers, New York and London. $8.00. xiv + 533 pp.; ill. 1950.

This text is an English translation of the second (1945) French edition of Jean Brachet's *Embryologie Chimique.* Many reviews of this important work have previously appeared, including one by the present reviewer (Science, 102:337, 1945). Comments may therefore be restricted to the merits of the translation.

In the aforementioned review it was remarked that the French edition "is written in a simple and direct style and should be readily intelligible to anyone with an elementary knowledge of French." Evidently the publisher and translator had discovered that interest in this work is considerably more widespread than the requisite knowledge of French. This, itself, is a tribute to the excellence of the original work and also a commentary on the development of the field of chemical embryology.

For the difficult task of translating a scientific work it is unquestionably desirable that the translator be well informed in the specific field. In this respect an excellent choice has been made, for Lester G. Barth is one of the foremost workers in the field of experimental embryology and has had broad, first-hand, familiarity with a large part of the material that is presented. His understanding of the topics that are presented has insured high reliability of the translation as an expression of the original author's views. It may be noted, in this regard, that the translator did not inject his own views and interpretations into the text, even in instances (e.g., the discussion of neural differentiation of ectodermal explants of gastrulae of *Amblystoma*, p. 351) where, as indicated by his own publications, he is evidently not in complete accord with Brachet's conclusions. This is of course appropriate, since the work is essentially a straightforward translation with very little reediting. The latter consists of occasional statements in the text referring mainly to more recent investigations, which, however, do not appear in the bibliography (e.g., the reference to Van Cleave, p. 421).

The text is printed in the fine form characteristic of Interscience Publishers, and typographical errors are rare. However, neither they nor the authors have discovered a method of avoiding the inevitable printing mistakes that occur in a work of this size (e.g., the omission of an entire line, p. 299).

While one may find instances of somewhat clumsy expression, resulting from too literal translation, the text reads very smoothly as a whole. It is doubtful that anyone else would have done a better job than Barth in rendering this valuable work available in readily comprehensible English.

ALBERT TYLER

TISSUE CULTURE TECHNIQUE. *Second Edition.* *By Gladys Cameron. Academic Press, New York.* $4.20. xii + 191 pp.; ill. 1950.

Almost all of this well-known book (see *Q.R.B.*, 10: 456. 1935) in the second edition, has been rewritten and brought up to date. It needs very little introduction to students in this field.

EARLY EMBRYOLOGY OF THE CHICK. *Fourth Edition.* *By Bradley M. Patten. Blakiston Co., Philadelphia and Toronto.* $3.50. xiv + 244 pp. + 4 pl.; text ill. 1951.

A new edition of this excellent textbook, after an interval of 22 years (*Q.R.B.*, 5: 117. 1930), will be welcomed by all students of embryology. There are a number of new illustrations, and improvements in typography have permitted enlargements of some of the diagrams, and also enlargements of explanatory type, without any increase in the physical size of the volume. The section on the mechanism of gastrulation has been entirely rewritten, in view of considerable recent work which has happily liberated us from the necessity of presenting chick gastrulation as the Procrustean bedfellow of amphibian gastrulation.

EVELYN HOWARD

EMBRYOLOGY OF THE CHICK AND PIG. *A Laboratory Manual. 3rd Edition.* *By Bruce M. Harrison. Wm. C. Brown Co., Dubuque, Iowa.* $3.50. (Paper). v + 259 pp.; ill. 1950.

This revised edition of a manual designed to deal primarily with the development of chick and pig includes directions for study, drawings to be labelled, and questions to be answered on various laboratory exercises. It will probably be satisfactory to those whose courses are administered at such a level that this is the type of manual employed.

JANE OPPENHEIMER

GENETIC NEUROLOGY. *Problems of the Development, Growth, and Regeneration of the Nervous System and Its Functions. Conference Sponsored by the International Union of Biological Sciences, Subsidized by UNESCO.* *Edited by Paul Weiss. University of Chicago Press, Chicago.* $5.00. xii + 239 pp. 1950.

In March, 1949, there was held the First International Conference on the Development, Growth, and Regeneration of the Nervous System, at the University of Chicago, under the sponsorship of the International Union of Biological Sciences. Its purpose, according to the editor of this volume, was "primarily to compare experiences, clarify ideas, scrutinize current notions, remove inconsistencies, sort knowledge from conjecture, and, above all, point up the vast areas of ignorance in need of elucidation." No formal papers were required or read—in the light of which fact it seems most remarkable that the editor has prevailed upon the speakers to complete these manuscripts, in time to publish them for the benefit of the present generation of investigators.

It would be impossible in a review to comment upon the myriad problems discussed in these outstanding contributions to the literature—contributions from histology, embryology, cytochemistry, biophysics, and physiology. As Weiss points out, the 6 main sessions of the conference were devoted to 6 "relatively separable" topics:

1) the differentiation of the central nervous system and of its units;

2) the outgrowth of nerve fibers and the establishment of nerve connections;

3) the growth and trophic relations of neurons;

4) the regeneration of nerves, including implications for the clinical problems of nerve repair;

5) the problems of specificity and selectivity in the development and operation of the nervous system; and

6) the development of behavior and its neural foundations.

Problems of neuronal differentiation include those of "allocation" of materials from various sources in the embryo, modifications of these substances, cell and process migration, spatial regrouping, recruitment of cells, growth, proliferation, loss of cells by destruction or emigration, etc. These topics are discussed by Hamburger, Levi-Montalcini, Stefanelli, Piatt, and Lewis. Many fundamental concepts are brought out, such as that of the existence of many different species of neurons—many more than can now be identified physiologically. The fact of specific differentials among neurons is emphasized many times in this series of papers, notably by Schmitt, Bodian, Speidel, Young, and Sperry. Schmitt describes the use of such biophysical tools as polarized light, x-ray diffraction, and electron microscopy in the analysis of neuronal structure, growth, and differentiation.

The evidence relative to trophic interdependence of neurone and end-organ, and to interrelationships of neurone and related structures, is of great interest, as is the recent work tracing biochemical correlates of nerve differentiation (Flexner, Bodian, and Hyden). "These studies are particularly interesting, in that they demonstrate definite correlations between the development of certain biophysical and biochemical properties, and the inception of functional operation in the respective nerve centers." It is particularly gratifying to see the application of this particular kind of biophysics and biochemistry to studies of the nervous system. Biophysical concepts and tools have been applied in other ways, especially in electrical studies. However, much of the recent work of the latter variety makes one wonder if the active pursuit of such electrical investigations has not brought the neurophysiologist to a point where he cannot do much more than determine more precisely the parameters of what he already knows. The present series of papers certainly demonstrates a variety of other methods of attack which will permit the investigation of many stimulating problems, and afford the production of most stimulating new concepts of nervous structure and activity.

As in other recent conferences concerned with some of these problems, there was some discussion of the neurologic foundation of behavior (Hooker, Windle, and Barron). "It was highly encouraging to the conference to see how the spirit of exploration overcomes doctrinary ties and how research on the development of behavior and of its neural basis is proceeding with renewed vigor."

Paul Weiss is to be congratulated for having edited one of the most stimulating books concerned with the investigation of the nervous system to appear in recent years, even if one is not in full agreement with the choice of *Genetic Neurology* for its title. As Gerard points out, in a particularly interesting paper, the fact that development and function have tended to be studied by separate groups is an unsound dichotomy. Since, in the nervous system, "spatial and temporal considerations dominate as in no other system," and since these factors operate in both development and function, it is essential to bring these spheres more closely together. In this, the conference was markedly successful.

R. G. GRENELL

A HANDBOOK OF THE MEASUREMENT AND INTERPRETATION OF HEIGHT AND WEIGHT IN THE GROWING CHILD. *Monogr. Soc. Res. Child Devel., Ser. No. 48, 1948, Vol. XIII, No. 3.*

By Wilton Marion Krogman. Child Development Publications, Northwestern University, Evanston, Ill. $1.50 (paper). x + 68 pp.; ill. 1950.

ANIMAL MORPHOLOGY

THE MORPHOLOGY OF OSTRACOD MOLT STAGES. *Ill. biol. Monogr., Vol. XXI, Nos. 1–3.*

By Robert V. Kesling. University of Illinois Press, Urbana. $3.50 (paper); $4.50 (cloth). viii + 324 pp. + 5 folding charts; text ill. 1951.

Somewhat less than half of this book is given over to text, bibliography, and index, while the plates and their facing captions occupy 194 pages. These plates are photomicrographs of sections of ostracods, and it seems questionable that all of them justify this expensive method of reproduction. The subject matter of this book is primarily one ostracod, *Cypridopsis vidua*, examined in elaborate detail. The author has tested various growth laws and formulae, and evidently favors a system utilizing triangular graph paper (which is not adequately explained). The study is intended to be of help to petroleum geologists in search of index fossils.

JOEL W. HEDGPETH

A MANUAL OF PRACTICAL VERTEBRATE MORPHOLOGY. *Second Edition.*

By J. T. Saunders and S. M. Manton. Oxford University Press, New York; Geoffrey Cumberlege, Oxford University Press, London. $4.00. viii + 255 pp. + 1 pl.; text ill. 1949.

The lack of attention given to any portion of the vertebrate muscular system in the first edition of this manual has been remedied by the inclusion of 6 chapters dealing with a representative selection of such systems. The text of the chapters on the dissection of the muscles was written by M. E. Brown. The general plan of this manual follows the first part of the Natural Sciences Tripos at Cambridge University. The selection of type specimens for dissection is varied but fails to include 2 types which are generally studied in American schools, the dogfish and the mammal. Except for a description of its osteology, directions for dissection of the mammal are omitted, on the ground that many excellent accounts of the dissection of the rabbit are easily available.

It seems doubtful whether this manual, even in its newly revised form, will have very wide acceptance in the United States as a standard laboratory guide, not only on account of the omissions already mentioned, but also because a number of the animals described in detail are not commonly utilized in comparative anatomy courses in American institutions. It should be useful as a supplementary source of information, especially since it has an index.

MAX KRAUSS

MANUAL FOR COMPARATIVE ANATOMY. *Revised Edition.*

By Leonard P. Sayles. The Macmillan Co., New York. $3.00 (paper). xii + 214 pp.; ill. 1950.

In the second edition of this manual, some revision of terminology has been made and errors appearing in the first edition have been corrected. A number of new illustrations have been added. The plan of the manual is that followed in a year's work in Vertebrate Anatomy at the City College of New York. The arrangement is by systems and several representative vertebrates are described in considerable detail. The manual is readily adaptable to a shorter course. All illustrations are labelled.

MAX KRAUSS

THE ANATOMY OF THE GORILLA. *The Henry Cushier Raven Memorial Volume. A Collaborative Work of The American Museum of Natural History and Columbia University. Arranged and Edited by William King Gregory. Columbia University Press, New York.* $15.00. viii + 259 pp. + 2 folding plates; text ill. 1950.

Henry Cushier Raven has made a great contribution to our knowledge of the gorilla not only through his field notes gathered on the 1929 Columbia University-American Museum African Expedition to the habitat of both the mountain and the coast gorilla, but also through his meticulous dissections of the embalmed specimens that he collected and brought back from the highlands of the Congo and French West Africa. The difficulties that he overcame in accomplishing this mission can well be understood by someone who has hunted gorillas under similar conditions, but who lacked the finesse to place his bullet in such a way as better to allow for the embalming of an adult male specimen.

Unfortunately the tropical diseases Raven contracted on this mission very nearly cost him his life, and did affect his health during the 15 years left to him.

The Anatomy of the Gorilla is a highly appropriate memorial volume to such an unusual naturalist and skillful anatomist, and appropriately contains contributions in the field of gorilla anatomy by such American scientific colleagues as Washburn, Elftman, Atkinson, Straus, and Schultz, who are among the best in their respective fields. The volume also contains an excellent account of Raven's life and writings by his devoted friend and senior associate, William K. Gregory, who carried through the final preparation of this work after the untimely death of John Eric Hill, also of the American Museum of Natural History.

The 4 life-size drawings of upper and lower limbs showing the musculature and blood supply, as well as many of the 112 other plates and 40 figures, give one a highly valuable visual presentation of details of gorilla anatomy that can be found in no other publication. Prior to this publication the recent contributions to our knowledge of gorilla anatomy had been widely scattered in scientific journals, and there was an urgent need for someone to prepare an anatomy of the gorilla that would serve the same purpose for those studying the anatomy of the great apes as Gray's for the anatomy of man.

The Raven Memorial Volume also serves a highly useful purpose, indicated throughout by the contributing authors, by indicating clearly the exact limitations of our present knowledge and the need for a great deal of further careful comparative study. For example, Straus indicates that variations in the anatomy of the viscera are so great that "a compilation of all recorded descriptions would be insufficient to free us from the vagaries of anatomical variation." He also states that much work needs to be done on the microscopic anatomy of the skin. The extensive lobation of the liver in the gorilla, as compared with man, is pointed out by Elftman and Atkinson and confirms numerous

previous descriptions. Even in 1872 Flower said, "The abnormal form of the liver of the gorilla is one of the most interesting facts that has been brought to light by recent researches into this subject. It shows either that the modifications of the liver are not very characteristic in natural and related groups of animals or that the gorilla ought not to occupy that position in the system which has hitherto generally been accorded to it."

Adolph Schultz's contribution on morphological observations fills in a few of the many remaining gaps in our morphological knowledge of the gorilla, such as age changes in head, trunk, and limb proportions, and cranial capacities. He points out the enormous variability of gorillas, indicated by a range in cranial capacity among 301 adult males from 420 cc. to 685 cc., and while the incidence of caries in the teeth was only 2%, alveolar abscesses were found in 17% of the adults and 60% of the old gorillas. Schultz also includes some pictures of wild gorillas (taken by Dennis) showing an advance case of yaws.

Most of the contributing authors have drawn on all previous published accounts and have related their findings to their studies of Raven's material and a few other specimens available to them. In this way the knowledge set forth, while often fragmentary, is nevertheless as up to date as it could be at the time of writing.

By way of summary, Part I of this unique memorial volume gives a story of Raven's life and tributes to him by his associates at the American Museum of Natural History, as well as a bibliography listing some 70 of his publications. Part II covers 173 pages of Raven's work on the Regional Anatomy of the Gorilla, with additions by John Eric Hill. Part III covers the Thoracic Viscera of the Gorilla (S. L. Washburn), and the Abdominal Viscera and Female Reproduction system (Herbert Elftman and William B. Atkinson); Part IV, The Microscopic Anatomy of the Skin (William L. Straus, Jr.); and Part V, Morphological Observations on Gorillas (Adolph H. Schultz).

This "magnum opus" would have pleased Henry Raven had he lived to see it in final form, but the incompleteness of our over-all knowledge of gorilla anatomy which it clearly reveals would also have served as a continuing challenge to one whom the late Perry Osborn so aptly described as "a great naturalist . . . a careful man of research with great powers of accurate and revealing description. And, like the knight whom Chaucer portrayed for posterity, he was indeed a 'gentle man'." This Memorial Volume is indeed a fitting tribute to Henry Raven, who will be long remembered not only by his many friends, but also by all those who will profit from his writings and the quality of his scientific work so well exemplified by his contribution to this significant publication on *The Anatomy of the Gorilla*.

HAROLD JEFFERSON COOLIDGE

HISTOLOGIE UND MIKROSKOPISCHE ANATOMIE DES MENSCHEN. *Erster Band: Zellen- und Gewebelehre.* *By W. Bargmann. Georg Thieme, Stuttgart.* DM 19.60. viii + 210 pp.; ill. 1948.

The writing of a short histology by a pupil of the renounced W. von Möllendorff, whose textbook is the most extensive and scholarly ever to have been attempted, is an effort requiring singular courage and self-confidence. On examining the volume under consideration, one wonders if there was wisdom in the decision. Very little new or unusual material has been included. Frequent reference, without explanation or other elaboration, is made to comparative anatomical backgrounds, often as positive statements about controversial topics. The author's style and vocabulary are unusual, and many passages give the impression that they would be clear only to a person already familiar with the subject matter. The illustrations, mostly line drawings and halftone plates, are abundant enough, but do not help the text much, apparently not having been chosen to illustrate critical or difficult points. The 1 color plate, of blood cells, is mediocre. Covering the cytology and histology of the fundamental body tissues without including (in this volume) any organology, the entire work gives the impression of a quite undistinguished, routine account of its subject. Its contribution to histological literature is a small one.

F. N. Low

NOSES.

By Harold M. Holden. The World Publishing Co., Cleveland and New York. $3.50. 252 pp. + 10 pl.; text ill. 1950.

Holden is a plastic surgeon and, reasonably enough, has become interested in the nose. In fact, as he points out, the nose has become his hobby. This book is the result of his hobby. By following the "nose" through a great variety of different areas, the author has succeeded in amassing an amazing number of facts and figures about the proboscis. The content ranges from the role of the nose in ancient religions up to Fourier analysis of the human profile. From time to time the author uses the nose as a jumping-off place to discuss related topics, such as smell, taste, the history of plastic surgery, and constitutional psychology. Everyone will find something new in this book. Did you know, for example, that the most aesthetic naso-facial profile angle was 25 to 30 degrees?

ROBERT A. MCCLEARY

THE COMPARATIVE ANATOMY AND PHYSIOLOGY OF THE LARYNX. *First Edition.*

By V. E. Negus; with a foreword by Sir Arthur Keith. Grune & Stratton, New York (printed in Great Britain). $6.50. xx + 230 pp.; ill. 1949.

This volume is a condensation of a lengthier book by the same author, *The Mechanism of the Larynx*, which first appeared in 1928. The original was acknowledged to be authoritative, dealing chiefly with comparative anatomy. The present version has a briefer text but more illustrations. The contents and approach are largely unchanged. The bibliography has most unfortunately been omitted.

The author's interpretations of his material are emphasized as much as its anatomy and physiology. Stress has been put on the initial phylogenetic origin of the larynx as an organ designed to prevent the entrance of anything besides air into the trachea and lungs. A wide variety of secondarily acquired functions concerned with olfaction, deglutition, respiration, and phonation have been developed in different forms. It appears to the author that the use of voice in mammals depends on their mode of life rather than upon any limitations set by the anatomy of the vocal apparatus. The very simple structures adequate for speech are present in most mammals and even in lower forms.

It is remarkable that such extensive and painstaking work has resulted from the hobby of an investigator who is primarily a surgeon. But the expansive interpretations of ecological factors, as well as the consistently teleological approach, reveal the writer to be essentially unskilled in the rigid disciplines of comparative anatomy. Revealing and interesting, while yet lacking the critical dialectic of the trained specialist, this book maintains its position as the most comprehensive work in its field. The interested but uncritical reader with some biological background should find it both instructive and easy to read.

F. N. Low

CONGENITAL ANOMALIES OF THE HEART AND GREAT VESSELS: *Clinicopathologic Study of 132 Cases. American Lecture Series, Pub. No. 47: A Monograph in American Lectures in Pathology.*

By Thomas J. Dry, Robert L. Parker, H. Milton Rogers, Jesse E. Edwards, Howard B. Burchell, and Arthur H. Bulbulian. Charles C Thomas, Springfield, Ill.; Blackwell Scientific Publications, Oxford; and The Ryerson Press, Toronto. $4.50. xiv + 68 pp.; ill. 1949.

This fine compilation of congenital cardiovascular malformations is one of the most attractive and useful yet produced. The material was originally an exhibit at the 1947 Convention of the American Medical Association and consists of separately presented examples of many of the better known anomalies. Each is depicted on 2 facing pages. There is a brief and concise text description of the anatomical, physiological, and clinical features of the defect, together with a case report. Colored reproductions of wax models, actual gross photographs, roentgenograms, and drawings and electrocardiograms where contributory, provide striking illustrations. There is a historical foreword, and each malformation is preceded by a brief historical excerpt from the work of some pioneer in the recognition or description of congenital heart disease, together with his photograph. A sound group of references is included at the end of the volume.

Since the work is based on a limited number of cases actually available to the authors, there is no attempt at completeness. The most unfortunate omission is that of any example of pulmonic stenosis with an intact ventricular septum, another condition that has recently shown promise of yielding to the direct attack of the surgeon's knife. The work is clinical, and there is no embryological discussion. This, however, is not a drawback since the subject is well covered in the bibliography. The reader will be pleased with the clarity and accuracy of the brief presentations.

E. Converse Peirce, 2nd

ANIMAL PHYSIOLOGY

ANNUAL REVIEW OF PHYSIOLOGY. *Volume XII.*

Edited by Victor E. Hall, Jefferson M. Crismon, and Arthur C. Giese. Annual Reviews, Stanford, Cal. $6.00. viii + 609 pp. 1950.

The character of the *Annual Review of Physiology* is now so well established that no words need be wasted in describing it. Vol. XII contains an interesting introductory essay by Eugene F. DuBois, Fifty Years of Physiology in America, followed by 22 reviews prepared by highly competent specialists in their respective fields: Physical Properties of Protoplasm (M. J. Kopac); Radiant Energy (A. Edelmann); Physiological Genetics (D. G. Catcheside); Growth (P. C. Zamecnik & J. C. Aub); The Physiology of Supporting Tissue (M. J. Dallemagne); Physiological Responses to Heat and Cold (J. D. Hardy); Water Metabolism (J. R. Elkinton); Respiratory System (W. O. Fenn, H. Rahn, & A. B. Otis); Digestive System (M. I. Grossman); The Coagulation of Blood and Hemostasis (A. J. Quick); Blood Gas Transport (R. C. Darling); Energy Metabolism (W. H. Chambers & W. H. Summerson); The Peripheral Circulation (O. G. Edholm); Heart (A. Hemingway); Kidney (J. Trueta); Conduction and Synaptic Transmission in the Nervous System (H. A. Blair); Somatic Functions of the Nervous System (A. A. Ward, Jr.); Visceral Functions of the Nervous System (R. B. Livingston); Physiology of Smell and Taste (H. D. Patton); Physiology of Vision (R. Granit); Metabolic Functions of the Endocrine Glands (J.

Tepperman & H. M. Tepperman); and Reproduction (S. A. Asdell).

An interesting point arises from a check of the articles in the very extensive lists of Literature Cited, when these are classified roughly into those appearing in American journals, those in journals publishing in English abroad (chiefly British), and those in journals published in non-English-speaking countries. (The latter of course, may include even a fairly high proportion of articles in English.) What appears is a decided contrast in the distribution between these 3 classes for the corresponding 3 groups of reviewers. The 2 reviewers representing foreign languages, one Belgian, the other Swedish, cited approximately one-third of their references from "non-English" journals, and slightly over 50% of their references were from journals published outside the United States. The British and Canadian reviewers (4 checked) cited about 15% of their references from the "non-English" journals, and a total of nearly 30% from journals published outside the USA. Reviewers from the United States, however, cited fewer than 10% of their references from "non-English" journals, and a total of only 20% from journals published outside the country. Among these 15 there was a variation all the way from 1.5% to 35% of citations from non-U. S. journals, with one reviewer, now working in France, actually citing 40% of foreign articles. These figures indicate the need for a broader study of the problem, but on the face of it one can hardly conclude otherwise than that the American scientist is fast becoming, not universally but to a staggering degree, a scientific *provincial*. It is perhaps true that the United States now leads the world in many fields of biological research, particularly in certain applied fields. But I wonder whether anyone would seriously maintain that over 90% of the significant work now being done in the field of *growth*, to take an example, is published in our American (U. S.) journals? This charge is not intended to be a reflection on one or a few. It is a serious indictment of our American scientific education and our scientific smugness and self-complacency. In Germany today biologists find it extremely difficult to obtain American journals and keep themselves informed about what American biologists are doing. This is solely a difficulty of currency and exchange. Here in the United States biologists are also grossly unaware of scientific work done elsewhere, and their ignorance is not all attributable to the Iron Curtain.

BENTLEY GLASS

HANDBOOK OF PHYSIOLOGY AND BIOCHEMISTRY (*Originally Kirkes' and later Halliburton's*). *Fortieth* (*Centenary*) *Edition.*

By R. J. S. McDowall. The Blakiston Co., Philadelphia and Toronto; John Murray, London (*printed in England*). $7.00. x + 767 pp. + 10 pl.; text ill. 1950.

This textbook is now over 100 years old. It has gone through 40 editions and has probably sold over 200,000 copies. It hardly needs introduction to most readers of this journal.

BEES. *Their Vision, Chemical Senses, and Language. By Karl von Frisch. Cornell University Press, Ithaca, New York; Geoffrey Cumberlege, Oxford University Press, London.* $3.00. xvi + 119 pp.; ill. 1950.

There is a masterful simplicity to this distillate of 40 years' research on bees that makes the first English translation of a book by von Frisch read like a classic. It is a model in its use of the familiar word and avoidance of unnecessary terminology. Von Frisch provides the basis for an understanding of his critical experiments, whereby he has shown clearly that the honeybee has color vision with 4 separate and distinct parts: yellow, blue-green, blue and ultraviolet. The meaning of flower colors in these terms has important significance, in terms both of honey-gathering and of pollination. Even the practical advantages of painting hives in these colors and in black, and the arrangement of painted hives in definite patterns, receives appreciation based on understanding.

But color and pattern sense are of value primarily at a distance. Closer up the bees rely on both odors and taste. Von Frisch presents good evidence to indicate that a honeybee's antennae, bearing the olfactory sense organs, react to approximately the same odors as do our own noses, but that because of their location, the insect's cues are on a micro-scale and probably include details of form as well as pure odor. Bees react to the 4 tastes as we do, although their appreciation of sweetness or bitterness does not coincide with human estimations of the chemical substances tried. These proven facts von Frisch extends to various applications—treatment of sugar sold cheaply to apiarists for feeding their colonies in winter but not suitable for kitchen use); or guiding bees to particular crop plants in which man is interested by feeding them sugar water while they are exposed to the flower scent concerned. Such applications present "a new example of a well-known fact—a fact not recognized at all times by all governments—that research work performed for its scientific interest alone often proves later to be of great practical value in ways which could never have been foreseen."

The means by which scouting bees or field bees inform others in the hive concerning new sources of food, indicating its kind, distance, and direction are clarified in a final chapter. Through study of marked bees (numbered from 1 to 599 with an ingeniously simple system of no more than 3 dots of paint of 5 different colors), a "round" dance in the hive was

found to be correlated with food closer than 100 meters from the hive, and a "wagging" dance beyond 50 meters, with intergradations in form through the 50 to 100 meter range. The odor of flowers remaining on the outside of the dancing bee's body, plus the chemical cues from small amounts of nectar regurgitated and donated freely during the display, serve to identify the odor to be sought at the food site. In the wagging dance the main direction of activity is related to the direction to the food, and the number of turns within 15 seconds (from 2 to 9) indicates the proximity in terms of flying time. Direction of dancing on the vertical surface of the combs is related to gravity, while the cues obtained from the dance by nearby bees are related by way of their own gravity senses to the plane of polarization of sky light. Through use of a cleverly planned disk made from eight pieces of polaroid film, von Frisch was able to suggest a correspondence between what the bee can see with the 8 sense cells around the central rhabdome of each ommatidium in its compound eye, and this seemingly uncanny ability to know direction from an isolated patch of sky. Experiments support these conclusions, though the end is not in sight.

"No competent scientist *ought* to believe these things on first hearing" is von Frisch's own conclusion, but W. H. Thorpe of Cambridge University and Donald Griffin of Cornell (who have each contributed a Foreword to the present book) have repeated some of the simple but crucial experiments with complete agreement in findings. No doubt the availability of these lectures by von Frisch will stimulate further work in other centers. He provides an up-to-date bibliography and an index.

LORUS J. & MARGERY J. MILNE

RESEARCHES IN BINOCULAR VISION.

By Kenneth N. Ogle. W. B. Saunders Co., Philadelphia and London. $7.50. x + 345 pp.; ill. 1950.

This is a research monograph rather than a comprehensive work on binocular vision. In it, the author has summarized and integrated a great number of studies on binocular vision conducted at the Dartmouth Eye Institute over a period of 18 years. Despite its summary nature, however, the book gives due weight to the work of other investigators in the field. The contents are generally organized around 4 major topics: the organization and sensory cooperation of the two retinas, the fusional process in binocular single vision, the problems in binocular vision when changes are made in the relative magnifications of the images of the two eyes, and the experimental and theoretical bases for aniseikonia. In bringing together in one book these important researches of the Dartmouth group, Ogle has made a significant contribution to visual science. Practicing ophthalmologists as well as research scientists should find this work of great value.

A. CHAPANIS

FLAVOR. *McGraw-Hill Series in Food Technology. By E. C. Crocker. McGraw-Hill Book Co., New York and London.* $3.00. viii + 172 pp.; ill. 1945.

Flavor is defined in this volume as "that quality of food which makes it register favorably or otherwise on the senses." This definition plus a listing of the chapter headings conveys an accurate idea of the nature and scope of the subject treated. Discussed in turn are: The Elements of Flavor, The Physiology of Flavor Perception, Psychology in Flavor, The Language of Flavor, Natural Sources of Taste, Significant Elements in Popular Flavors, Essential Oils of Flavor Interest, Volatility as a Property of Odoriferous Substances, Influences of Processing on Flavor, Flavor Changes in Storage, Organoleptic Technique, Consumer-testing of Foods, The Art of the Chef, Beverage Appraisal by Taste, and Commercial Quality Scoring.

V. G. DETHIER

KINESIOLOGY.

By Laurence E. Morehouse and John M. Cooper. The C. V. Mosby Co., St. Louis. $4.50. 435 pp.; ill. 1950.

This is a scientific study of body movements written primarily for students of athletics, physical education, and physical therapy. The objectives of the book are to improve performance in work and sport, and to make work easy and comfortable. Somewhat more than half of the book deals with general topics in the physiology of muscular exercise—the mechanics of human motion, center of gravity, posture, muscular movement and efficiency, and so on—which should be of interest to those in fields other than the ones mentioned above (e.g., industry). The rest of the book applies the principles of kinesiology to a variety of sports. The text is liberally illustrated. An appendix provides a 14-page list of the principal muscles of the body, their origins, insertions, and modes of action.

A. CHAPANIS

MUSCLES—*Testing and Function. By Henry O. Kendall and Florence P. Kendall. The Williams & Wilkins Company, Baltimore.* $7.50. xii + 278 pp.; ill. 1949.

For more than a quarter of a century the authors have conducted the physical therapy department in an institution in which paralytics are treated, students are taught, and orthopedic internes are trained, and where,

in addition, the comparative values of various forms of treatments are studied. These activities have led to the standardization of methods of examination and the maintenance of accurate quantitative as well as qualitative records of muscle power.

The experiences gained in examination, recording, and teaching have been incorporated in this book. The muscle evaluation is done by function tests and does not rely on mechanical apparatus. Through careful positioning and observation many of the composite movements are broken down to permit evaluation of individual muscles. Numerous clear photographs illustrate the position of fixation and the technique of testing. Reproduction of charts designed to help localize nerve lesions causing paralysis, and an appendix tabulating muscle functions and the origins and insertions of the individual muscles, add to the usefulness of the book. The material has been put together in a compact, readable manner, so that the volume can serve not only as a reference book but also as a textbook on muscle testing and functions.

I. Wm. Nachlas

The Urinary Function of the Kidney.

By A. V. Wolf. Grune & Stratton, New York. $7.50. xiv + 363 pp.; ill. 1950.

The subject of the renal physiology has long been a rather confused one. Looking around for reasons as to why this has been so, it is not difficult to appreciate that this subject embraces such a wide range of physiological phenomena, including body water balance, cardiac function, and endocrine metabolism, that to consider any one of these factors without its relation to the whole organism is to become a purveyor of further confusion.

In the first 6 chapters of this book, the author has covered many of the interrelations of body water. Chapter 7 is most interesting reading, for it deals with the more general and theoretic aspects of renal physiology. Chapters 8 and 9 consider diuresis and antidiuresis, and Chapter 10, endocrines in urinary function. To say that the over-all treatment is more than adequate is to indulge in gross understatement. If critical remarks need to be made, one can say that the author, in writing about one organ of the body, has, like all such authors, become somewhat preoccupied with the kidney to some neglect of the organism as a whole.

In a short review it is impossible to attempt any sort of detailed analysis of the various propositions presented. Mention of trivial errors does little in the way of informing prospective readers, so it seems best to comment on the general conclusions of the book. General physiologists will find here nothing in the way of ultimate mechanisms at the cellular level, nor will biochemists find neat charts of the sequence of chemical events (all fitted into a cycle). Indeed, the authors seems to have striven to avoid giving us any kind of model for kidney action. This is not said by way of criticism, as indeed the general theoretic treatment is most sophisticated and serves as a lesson, to those of us who like to make biological explanations by more and more complex models, that it may be possible to shed considerable light on a problem using a purely phenomenological mode of analysis.

For many reasons it appears that this book may well achieve the status of a classic, not the least of which is its beautiful style, combined with a clarity and precision of expression all too rare in current scientific monographs.

L. J. Mullins

La Coagulation du Sang. *Monographies du Centre National de Transfusion Sanguine.*

By M. Burstein; preface by A. Tzanck. Masson et Cie., Paris. 500 fr. (paper). ii + 172 pp.; ill. 1949.

A casual inspection of the wards of a busy medical service will quickly reveal that a fair proportion of beds are occupied by patients whose blood clots too well; occasionally, too, a bed is occupied by a patient whose blood clots hardly at all. Most of us are between the two extremes—in balance between the too much and the too little. Quite evidently, the proper coagulation of our blood is of major importance to our survival. In this excellent monograph Burstein describes the process of blood coagulation and its control.

The several chapters cover the following topics: general remarks on coagulation; prothrombin and the significance of prothrombin time and prothrombin content; thromboplastic protein; plasma prothrombin activators; platelets; calcium; role of contacting surfaces; thrombin; fibrinogen; clot retraction; fibrinolysis; vitamin K and acquired hypoprothrombinemias; hemophilia; chemistry pharmacology, estimation and dosage of heparin and dicumarol; clinical use of the anticoagulants. The discussion of these topics is clear, succinct, critical, and limited largely to current knowledge and recent work. There are some 466 references to the literature through 1948. The author has added an appendix of some 120 references of articles published in late 1948 and 1949 after the manuscript had gone to press. This monograph is well worth the attention of clinicians and clinical investigators who read French. It also contains much information that may be of interest to biologists.

F. P. Chinard

Hemostatic Agents. *With Particular Reference to Thrombin, Fibrinogen and Absorbable Cellulose.*

By Walter H. Seegers and Elwood A. Sharp. Charles C Thomas, Springfield, Illinois. $4.50. xii + 131 pp.; ill. 1948.

Successful fractionation of many of the proteins involved in blood-clotting has provided pure substances for the study of the clotting mechanism and added a number of interesting materials to the surgical armamentarium. The authors have reviewed the basic aspects of clot formation in a sound manner and describe the use of concentrated thrombin, fibrinogen, and fibrin foam in clinical practice. Thrombin and fibrin foam have been used with outstanding results primarily for hemostasis under unusual circumstances, such as in brain surgery, while fibrinogen has been employed with some success to promote adherence of skin grafts and to facilitate removal of kidney stones. Two unrelated but widely used hemostatic agents, oxidized cellulose and gelatin sponge, are also discussed. The book brings important related material together for the first time and includes an extensive bibliography.

E. Converse Peirce, 2nd.

Coagulation, Thrombosis, and Dicumarol, *with an Appendix on Related Laboratory Procedures. Studies in Biochemistry (edited by Bruno Kisch and Carl Neuberg)—Vol. II.*

By Shepard Shapiro and Murray Weiner. Brooklyn Medical Press, New York. $5.50. xii + 131 pp.; ill. 1949.

This small book is intended for clinical pathologists and physicians who do not have an extensive or specialized knowledge of the problems of coagulation. It aims to furnish the information needed for the intelligent use, on a wide scale, of dicumarol and other anticoagulants in the treatment of thrombo-embolic diseases. The subject is not presented exhaustively, and except when necessary for clear understanding, highly technical and controversial matters have been largely avoided.

The early chapters include a discussion of the mechanism of coagulation and the part played by coagulation and other factors in hemostasis. The treatment of thrombosis is discussed, particularly with reference to dicumarol: its effect on coagulation factors, the indications for and mode of its administration, toxic effects, and the measures necessary for avoiding them. An appendix contains the detailed technic of pertinent laboratory procedures, particularly the Link-Shapiro modification of Quick's one-stage method of determining "prothrombin time," and a chemical procedure for estimating the concentration of dicumarol in the plasma. There is an adequate bibliography.

The book naturally reflects the opinions of the University of Wisconsin group of investigators, as the earlier work of the senior author was carried out with them. Stress is laid on the value and greater safety of the intermittent administration of large doses of dicumarol (rather than more frequent, smaller "maintenance" doses), on the effectiveness of large doses of vitamin K in combatting hemorrhage if it occurs, and on the advantages of the Link-Shapiro method of determining "prothrombin time" (including the use of diluted plasma) as a practical means of controlling treatment. These points are questioned by some other investigators. The imperative necessity of controlling treatment by suitable tests of coagulation is rightly stressed, and also the fact that the "prothrombin time" does not depend solely upon prothrombin but upon other substances as well.

The book is clearly and simply written, although the diction could be improved. It is adequate, yet not too technical or abstruse for the readers for whom it is intended. For such it should be of real value and is recommended.

P. W. Clough

Blood Clotting and Allied Problems. *Transactions of the Third Conference, January 23-24, 1950, New York.*

Edited by Joseph E. Flynn. Josiah Macy, Jr. Foundation, New York. $3.00. 224 pp.; ill. 1950.

The Transactions of the first two Conferences have been previously reviewed (*Q.R.B.*, 25: 415–16. 1950). This report is similar to the others in its scope and includes 14 technical papers with a complete transcript of the discussions, which are extensive, illuminating, and unobtainable elsewhere.

Four papers are concerned with experimental and preliminary clinical studies of the new anticoagulants, phenylindandione, tromexan, and paritol. These substances resemble dicumarol, but in general their activity is exerted more promptly and is much more transient, so that there is little risk of protracted hemorrhage from overdosage. Their clinical usefulness is not yet established. The value of vitamin K in controlling hemorrhage caused by dicumarol was discussed, the consensus of opinion being that it has a definite effect but is usually inadequate in case of severe or protracted overdosage.

Jacques and Spinks, discussing factors Affecting the Prothrombopenic Action of Dicumarol, describe experiments with dicumarol which had been labeled with radioactive carbon, particularly with reference to its distribution in the liver and other organs and the route and rate of elimination. Wood et al. report further studies of the zeta-potential of various diluted preparations of blood and plasma and the changes produced by adding heparin and other substances to such mixtures. Several other papers are devoted to the "so-called prothrombin tests" and the various coagulation factors which may be concerned in their

outcome. There was increasing agreement that these tests, and especially the one-stage test of Quick, do not specifically measure prothrombin but are also influenced by other variable factors. The test might better be called an "accelerated coagulation" test. Extensive clinical experience has shown, however, that the test is an extremely useful and usually reliable practical means of controlling the dosage of dicumarol.

The book is not intended for the uninitiated. Those who are working along these lines or who have a fair general knowledge of the subject will find it a convenient source of valuable new information.

P. W. CLOUGH

THE PHYSIOLOGY AND PATHOLOGY OF EXPOSURE TO STRESS. *A Treatise Based on the Concepts of the General-Adaptation-Syndrome and the Diseases of Adaptation.*

By Hans Selye. Acta, Montreal, Canada. xx + 822 pp. + 203 pp. references; ill. 1950.

This volume is a detailed presentation of Selye's theory of the influence of stress on physiological and pathological processes. The outline of the theory is simple. Agents which derange the normal function of a large number of body cells produce stress reactions in the organism (e.g., burns, strong drugs, temperature extremes, emotion, infection). While these agents may have diverse specific and local effects in the body, they also produce in common general *non-specific, systemic reactions*. These reactions are attempts of the organism to adapt to stress, or are the byproducts of such attempts. For this reason Selye calls this pattern of reactions the *general adaptation syndrome* (G.A.S.).

The G.A.S. is divided into three stages. First is the *alarm reaction* in which the organism is in a state of shock. Its body temperature falls, blood sugar rises and then falls, the adrenal and pituitary glands are overactive, and the nervous system is depressed. Most of these changes reverse themselves in a countershock reaction, which develops into the second stage, that called the *stage of resistance*. In this, the organism develops an increased resistance to the specific stressful agent, but decreases its resistance to all other kinds of stress. Finally, there is the *stage of exhaustion*, which occurs if the organism is exposed to prolonged stress. Resistance to the stressful agent collapses, and the symptoms of the alarm reaction return.

In some cases, non-specific resistance is developed such that the body can withstand other stresses than the one to which it has adapted. Regardless of successful resistance, however, the organism pays for adaptation and may develop what Selye calls *diseases of adaptation* (e.g., adrenal tumors, vascular lesions, gastrointestinal erosions, rheumatism, arthritis, various psychosomatic disorders, etc.).

Selye reviews a vast amount of literature to present and support his theory (about 6000 references). He draws from human clinical material, but leans most heavily on studies of stress in experimental animals. His primary aim is to use his theory to suggest mechanisms for various cases of adaptation and for the genesis of diseases of adaptation. In doing this, he gives central place to the hypothalamus and the hypophysis as the integrators of defense against stress. These centers, operating largely through the adrenal cortical system, are also responsible for the organ changes seen in the diseases of adaptation.

Selye is speculative, but he is also scholarly. He has made a bold attempt to bring together, in one theory, many previously unrelated medical and physiological facts. He recognizes his hypotheses as tentative, but uses them to build a logical groundwork for the study of stress.

ELIOT STELLAR

BIOLOGICAL STUDIES WITH POLONIUM, RADIUM, AND PLUTONIUM. *National Nuclear Energy Series, Manhattan Project Technical Section, Division VI, Vol. 3.*

Edited by Robert M. Fink. McGraw-Hill Book Co., New York, Toronto, and London. $3.75. xvi + 411 pp.; ill. 1950.

In the Editor's Preface, it is stated that this book is based on some ten Progress Reports, Technical Papers, and Articles describing researches carried out by the Division of Radiobiology at the University of Rochester under contract to the Manhattan Project and the Atomic Energy Commission. This material has been edited so that the proper coherence and integration into book form could be achieved. Despite this editing, the volume, which deals with the distribution, retention, and excretion of polonium, radium, and plutonium in a number of rats and a few humans (leukemics), suffers from overwriting. There is a tedious preoccupation with minor details (e.g., how to make intravenous injections into a rat's tail) and uncritical presentation of enormous amounts of data of no particular significance. Here and there many useful experimental procedures are described, but the reader is required to wade through a morass of tabular and clinical material to find them. The sections on polonium and radium offer little that is new to physiologists versed in the older literature. The section on plutonium can have only a morbid kind of interest to most radiobiologists because the material required to repeat the experiments described and to elaborate them further is inaccessible to all but those workers employed by the A.E.C. or contractors.

Little of this criticism is intended for the brave and devoted band which did the work. The trouble can best be analyzed by a consideration of the fascinating

prefaces which come after a brief Foreword by David Lillienthal, which sounds a note of hope and high purpose that unfortunately only serves to place the material following in a more unfavorable light than if it had not been included. As the first preface points out, there will eventually be some 60-odd volumes divulging what is considered "declassifiable." In view of what has already been remarked, this may be a rather depressing prospect. It is the next preface which brings the reader up with a start and turns the flame of hope to ashes. Thus, we are told that it was necessary to conduct these researches in a complex set-up complete with "ten autonomous but mutually interdependent divisions." There were priorities, materials, man-power, concentration of effort (invariably "channeled into the proper direction"), security, and regulations. It was difficult for the "investigator to reconcile his ideas and personal ambitions with those of a group for a common objective, especially when frequently his entire training and previous progress have been based upon individual achievement." It is considered surprising that such a system of submersion worked. Well, there was a war on and the fate of most scientists was indistinguishable from that of any other citizens. If it is a matter of doing routine work and turning out a mass of essential but non-fundamental data, then a system of coercion and individual abasement inseparable from a war effort will do a sufficiently satisfactory job.

The thought is expressed that "the system worked surprisingly well under somewhat unfavorable conditions and is worthy of further exploration under peace-time conditions." Most biologists will draw a different conclusion about the desirability of such further explorations. The confusion between the aims of fundamental science and engineering science is well exemplified by the quoted remarks. Preoccupation with man-hours, and emphasis on the conventional and routine work of science are indeed drawbacks which render it surprising that the system worked as well as it did.

C'était la guerre, cela se voit.

MARTIN D. KAMEN

STEROID HORMONES AND TUMORS. *Tumorigenic and Antitumorigenic Actions of Steroid Hormones and the Steroid Homeostasis—Experimental Aspects.*

By Alexander Lipschutz. The Williams & Wilkins Co., Baltimore. $6.00. xiv + 309 pp.; ill. 1950.

A. Lipschutz, who has been engaged for many years in the field of experimental endocrinology, presents in this monograph the investigations carried on in his laboratory since 1936, together with an extensive review of related research work. The book is divided into three parts: The Tumorigenic Action of Steroids and Its Implication for the Problem of Cancer; The Antitumorigenic Action of Steroids; and The Steroid Balance, or Steroid Homeostasis, and the Antitumoral Autodefense. The bibliography is very extensive, containing over 900 citations. Subject and author indices are satisfactory. The work is profusely illustrated with 111 figures and plates, chiefly from guinea pig material. The general planning and technical execution of the work is excellent and to be commended.

The author writes in his preface: "Use has been made in this book of new words as 'tumorigenesis,' 'tumorigenic' and 'antitumorigenic,' so as to include problems which refer to the origin, prevention and therapy of all kinds of neoplasms, not only malignant carcinoma and sarcoma, but also benign tumors, spontaneous or experimental, and even those processes which are on the border line between localized hyperplasia and neoplastic growth in the traditional acceptation." Indeed, the problems of hyperplasia and proliferation are given a greater share of attention than those of malignant response to steroids.

The researches of Lipschutz and his coworkers, which have dealt with the responses in guinea pigs to different estrogenic, androgenic, and adrenocortical steroids, given in different quantities and by different methods are discussed in great detail. Correlative investigations on other animals are adequately presented to form a broad picture of the formation of serosal and subserosal fibroblastic and myofibroblastic proliferations. The actions of progestational, androgenic, and adrenocortical steroids as antifibrogens (AFG) are described. The final third of Lipschutz's work presents experiments in steroid balance or steroid homeostasis.

To allow any impression that this work is limited to a critical report of a monumental amount of the author's research and of collateral investigations would be unfair. The amply presented technical details are set in a background of much stimulating and often thought-provoking discussion and interpretation of the data. The usefulness of this book is thus much enhanced.

There is, unfortunately, a disconcerting part of this book, which should not escape the reviewer's comment, namely, the title. Useful and important the book is; yet the author hardly deals with the broad scope implied by the title *Steroids and Tumors*. Nevertheless, the work is worthwhile and to be recommended.

M. C. SHELESNYAK

RECENT ADVANCES IN PHARMACOLOGY.

By J. M. Robson and C. A. Keele. Blakiston Co., Philadelphia. $5.50. xii + 418 pp. + 5 pl.; text ill. 1950.

The authors state that their purpose in writing this

textbook was to prepare a survey of recent developments in pharmacology of interest to students and practitioners of medicine. They have attempted to give an account of mechanisms of drug action and the basis for their use in practice, for a large group of the newer drugs. It is recognized that the entire field of pharmacology is too vast to cover completely, and therefore only certain segments have been reviewed. These are: anticholinesterase drugs; curare and tetraethylammonium salts; antihistamine drugs; drug allergy; the steroids of the gonads and adrenal cortex; the thyroid; bacterial chemotherapy; antimalarial drugs; antrycide; the chemotherapy of malignant disease; mutagenic substances; analgesic drugs; the hemopoietic system; anticoagulant drugs; the mode of action of drugs; methods of studying the fate of drugs in the body; the evaluation of the actions of drugs in man; and the control of the body functions by chemical substances.

Once again the question of drug nomenclature has been so vexing to the authors that they have commented upon this problem in the Preface. The difficulty of drug names is one that calls for an International Pharmacopeia for proprietary and non-proprietary drugs. The text is excellently written and reading the various sections was enjoyable. As a review of the field, the volume is to be recommended.

C. JELLEFF CARR

ANIMAL NUTRITION

LA DÉNUTRITION: *Clinique-Biologie-Thérapeutique.* *By Maurice Lamy, Michel Lamotte, and S. Lamotte-Barrillon. G. Doin & Cie., Paris.* 9,150 fr. (paper). 407 pp. + 8 pl.; text ill. 1948.

During World War II countless numbers of persons had the horrifying experience of undergoing starvation. Many publications have already appeared which report the conditions of extreme undernutrition in concentration camps, in territories held by enemy troops, and in the countries exhausted by their own military efforts. This monograph deals primarily with the undernutrition of Frenchmen held in German labor camps during much of the last war. In addition, some observations are recorded concerning the poor nourishment of people who had to live in the large area of France occupied by the German armies from 1940 to 1945.

The first part of the monograph outlines with fair success the accepted requirements for various dietary essentials and briefly reviews the intermediary metabolism of a number of the dietary components. Most of the remainder deals specifically with starvation. The clinical and laboratory observations were made on 40 severely undernourished adults soon after their liberation from the German detention camps. The observations, as reported, include body weight changes during convalescence, electrocardiograms and related cardiovascular measurements, body temperature, radiographs of the skeletal structures, concentration of various substances in the blood, kidney function tests, excretion of certain vitamins in the urine, and blood coagulation properties—in connection with the known association of phlebitis with inanition, physico-chemical state of serum proteins, capillary permeability, and blood volume. The changes in the distribution of body water are discussed extensively. A large number of the observations are in agreement with those already published by various investigators. The principal new claim of the authors is that various of the lesions and dysfunctions in starvation are attributable to the action of abnormal protein derivatives arising from the tissues. One is reluctant to agree that the evidence presented is conclusive enough to support this interpretation. A number of the authors' conclusions should be viewed with scepticism owing to the lack of definite controls and the provision of too little data on many of the variables.

In spite of the monograph's shortcomings, biologists and physicians interested in any aspect of undernutrition will find it of value because it does contain a great deal of information and suggestions on this important subject. One of the most useful features is the extensive bibliography. Over 700 references are listed. These are arranged alphabetically and the titles are included.

HARRY G. DAY

INDUSTRIAL NUTRITION. *By Magnus Pyke. Macdonald & Evans, London [Edward W. Sweetman, 1 Broadway, New York 4, N. Y.].* 10s. x + 205 pp. 1950.

In this carefully prepared little volume, the author has attempted to set forth some of the necessary guiding principles for providing meals "on the job" for industrial workers. The work had its origin in the author's conviction that for a nation to derive the greatest benefit from the present scientific knowledge of nutrition, that knowledge should be applied to the dietary regimen of its working population. Although the subject matter and recommendations are drawn largely from British experiences, much that is here is applicable to any country in the world.

The general theme of the volume is that if the scientific knowledge and methods of nutrition are to be applied effectively in industrial cafeterias and dining rooms, the dietitian must have a thorough knowledge of the eating habits of the workers not only at their jobs, but in their homes as well. One of the guiding principles in industrial nutrition stressed by the author is that although nutritional standards based on average requirements may be established, any individual canteen or system of catering must be sufficiently flexible

to provide for the needs of those workers whose requirements and tastes differ most markedly from the average. Suggestions are included for providing meals for workers employed in a wide variety of occupations, and for night as well as day shifts. A plea is made for consideration of the social needs of the workers while dining, the price of the meals, the attractiveness of the surroundings, and above all, the fact that the worker is a person, and not just another calorie burner.

The volume will undoubtedly find its greatest usefulness in the hands of the dietitian assigned to large industrial establishments. Author and subject indices are provided.

B. AUBREY SCHNEIDER

LINTON'S ANIMAL NUTRITION AND VETERINARY DIETETICS. *Third Edition.*

By John T. Abrams. W. Green & Son, Edinburgh. 42s. xii + 521 pp. + 15 pl. 1950.

The 3rd edition of Linton's *Animal Nutrition and Veterinary Dietetics* has been prepared by John T. Abrams, Lecturer in Nutrition at the Royal Veterinary College in London. The large volume of new experimental evidence since the publication of the 2nd edition in 1943 has necessitated considerable rewriting of the book; however, there have been deletions as well as additions, so that this latest edition differs little in length from the preceding one.

Some changes have been made in organization. Its usefulness has been increased by the designation of chapters under sections and of more definite subdivisions of chapters. Although the table of contents of the new edition shows only the grouping of chapters under sections and their titles, detailed outlines of the chapters are provided at the beginning of each. Material dealing with the preparation and storage of foods is included in Section II, instead of being Section III, as in the previous edition. The present Section III considers "the basic needs of livestock for maintenance, growth, reproduction, lactation, and work." It has been introduced to provide a link between the first two sections dealing with feeds and the last section (IV), which is concerned with the practical aspects of feeding. The book as a whole is improved by a much more complete listing of references.

Under Section I, The Chemical Composition and Metabolism of Nutrients, the new material is found mainly in the chapters on proteins and vitamins. Much of the revision and expansion of the discussion of the digestibility and biologic values of proteins is based on research since 1943. About half of the literature pertaining to vitamins was published subsequent to the preceding edition, and almost one-third of the references have to do with vitamin A, to which the most space is still given. Biotin and choline, formerly listed as "other vitamin factors," and inositol, folic acid, and vitamin B_{12} have been added as members of the vitamin B-complex. The discussions of niacin, pyridoxine, and pantothenic acid have been expanded.

Although little new material is included in the section dealing with foods and their preparation and storage, much of it has been rewritten. A few feeds described in the previous edition have now been omitted, while a few others have been added. In the chapter which described different methods of arriving at the energy value of foods, there is the significant conclusion that "the environment—using the word in its broadest sense—in which the animal is situated and the nature of the creature itself" are as important in animal nutrition as the nature of the food fed.

The section on the feeding of animals now includes chapters on goat and laboratory animals, including rats, mice, guinea pigs, golden hamsters, and ferrets. A new chapter deals with small domesticated carnivora (dog, fox, and mink).

The last chapter of Section IV and of the book, The Efficiency Factor in Nutrition, consists of 2 parts. The first part deals with the efficient purchase of feeds. The second discusses the need for "increased efficiency in the conversion of crops into animal foods suitable for human consumption" as one way of meeting the problem of feeding the world's ever-growing population. This book should find a useful place, both as a textbook and as a reference work for students of animal production.

L. A. MAYNARD

RECENT ADVANCES IN NUTRITION, *with Particular Reference to Protein Metabolism. Porter Lectures, Series 14. By Paul R. Cannon, in collaboration with Earl P. Benditt, Laurence E. Frazier, Eleanor M. Humphreys, Harold C. Steffee, Robert W. Wissler, and Robert Woolridge. University of Kansas Press, Lawrence.* $2.00. vi + 74 pp.; ill. 1950.

This is a short monograph dealing, for the most part, with Cannon's researches during the war. It discusses: 1) the dietary essentials and their relation to tissue protein synthesis; and 2) some of the pathological aspects of protein nutrition and their relationship to amino acid metabolism.

VITAMIN E. *Ann. N. Y. Acad. Sci., Vol. 52, Art. 3. Edited by Karl E. Mason; by 118 authors. The New York Academy of Sciences, New York.* $4.50 (paper). Pp. 63–428; ill. 1949.

This monograph contains 62 papers read at the Second International Conference on Vitamin E in the New York Academy of Sciences. The papers are arranged in 5 groups. The first 17 papers report on the morphological changes found as a result of the deficiency. The

acid-fast pigment in the uterine muscles and other organs of deficient rats has been found to be a lipofuscin resulting from the polymerization of oxidized unsaturated fat, and is possibly identical with the "ceroid" found in the cirrhotic liver of rats fed a low-protein diet. Occurrence of this pigment is much more constant than testicular atrophy or muscular dystrophy. Testicular degeneration of male rats can be used as a means of bioassay. Estrogens decrease the accumulation of this pigment. These changes can be delayed also by feeding oxidized instead of fresh lard to the rats. The endometrial fibrosis is related to the advanced age and not to vitamin E deficiency per se. Hypervitaminosis favors the occurrence of hereditary lung tumors in mice. Chronaxymetric changes precede the clinical manifestations of deficiency.

The second group (7 papers) deals with the influence of vitamin E on enzyme functions. Inhibition of succinic oxidase by α-tocopheryl-phosphate was found to be non-specific, is caused by the conjugation of the vitamin with albumin, and is relieved by addition of calcium ions. Transaminase activity is decreased in deficient guinea pigs and rabbits. Vitamin E preserves the vitamin A content of liver, and conversely vitamin A deficiency intensifies the muscle lesions of vitamin E deficient animals. α-Tocopheryl-phosphate promotes phosphorylation and inhibits hyaluronidase activity, inhibits the succinoxidase activity by its adsorption on the enzyme surface, preventing association with the cytochrome in vitro. α-Tocopheryl-phosphate in vivo (in the normal rat) produces muscular weakness and depresses the basal oxygen consumption and endogenous respiration of the skeletal muscle, but not of liver or brain. Intermediary oxidation products of the vitamin are discussed.

The third group (5 papers) deals with the protective action of vitamin E in conditions of metabolic stress. Interrelations of vitamin E and the amount of casein in the diet, the protective action of vitamin E on the liver of animals on a low casein intake from chloroform and cod liver oil damage, and the protection of red blood cells against hemolysis by alloxan and related compounds are discussed.

The fourth group (16 papers) concerns the nutritional aspects of the vitamin. Vitamin E requirements of farm animals and the influence of deficiency on the fat content of cow's milk are discussed. While reproductive activities are not affected in cows, they are lowered in sows, and in the latter species muscular dystrophy is noted also. Serum tocopherol levels in cows and mares are independent of pregnancy, parturition, and lactation. Vitamin E deficiency in rhesus monkeys was studied. The vitamin E level in human serum was studied by 2 groups of investigators, little or no correlation being found with clinical symptoms. Tocopherol assays in animal tissues and food were reported.

The last 17 papers report the use of vitamin E in clinical medicine. The standardization of commercial preparations is presented. Rather contradictory therapeutic experiences were reported in diabetes, rheumatic arthritis and heart disease, coronary heart disease, and thromboangiitis obliterans. Two groups of investigators reported favorable results in the treatment of primary fibrosis (Dupuytren's contraction, Peyronies' disease).

LASLO KAJDI

BIOPHYSICS

IONIZATION CHAMBERS AND COUNTERS. *Experimental Techniques. First Edition.*

By Bruno B. Rossi and Hans H. Staub. McGraw-Hill Book Company, New York. $2.25. xviii + 243 pp. 1949.

The National Nuclear Energy Series was an ambitious program to make available to the scientific public the vast amount of useful information obtained on the Manhattan Project. This volume is one of the few numbers of this series to see the light of publication. So much time has now elapsed since the termination of the Manhattan Project that the value of further publication of the series can certainly be questioned. However, the information contained in this volume is welcome to both those designing counters for tracer application, and especially to the biologist using high radiation fluxes as an experimental tool.

The first section is devoted to a discussion in mathematical terms of the basic phenomena upon which the detection and measurement of ionizing radiation is dependent. Of special merit is the inclusion of much valuable experimental data, especially the chapter on Gas Multiplication. The latter portion of the book is devoted to actual detector design. Recent developments in this field, presented both in recent publications and by new products now commercially available, make much of this portion of the book either obsolete or merely of academic interest. This book is for the specialist in radiation measurement, whether physicist or biologist, since the techniques presented must be critically assessed in light of recent developments in this rapidly advancing field.

ROBERT BALLENTINE

ADVANCES IN BIOLOGICAL AND MEDICAL PHYSICS. *Vol. II.*

Edited by John H. Lawrence and Joseph G. Hamilton. Academic Press, New York. $7.80. xii + 348 pp.; ill. 1951.

A book on recent advances in any series of subjects has many needs to try to meet, such as reporting observa-

tions and conclusions of various workers, distinguishing matters for emphasis, and, ideally, affording a careful evaluation of these results in their relation to the whole field under consideration. This book appears to accomplish the first objective quite well and does so in a readable style in most instances, although 10 contributors have composed its chapters. Much less is to be found regarding the significance and evaluation of the work in this field, although that is difficult to do, considering the large number of publications which are pouring out on these subjects today.

Very little attention is given to the stable isotopes which have so many special advantages in medical and biological research and with which much work has been done. Heidelberger refers to several items in this field.

The Biological Effects of Radiations (Howard J. Curtis) is a convenient short survey of this great field in which the results are widely scattered or compiled in large books. The subject is rather obscure and therefore difficult to present in any systematic fashion. The author seems to do well in summarizing recent observations in this field. A chapter on Molecular Exchange and Blood Perfusion Through Tissue Regions (Hardin B. Jones) is addressed to specialists in that field. It provides stimulating reading on several aspects of the subject. The Application of the Carbon Isotopes to a Study of Animal Metabolism (Charles Heidelberger) gives another general view of a part of the isotope field and, as it is condensed, provides a quick introduction to the subject. The Radioautographic Technique (Dorothy Axelrod Heller) is a very succinct and useful work on this subject and should be of practical help to anyone who wishes to do radioautographic experiments.

The rest of the chapters, except that of Gofman, are useful summaries of the scattered work in various fields of application to biology. They cover much that is necessarily hard to bring together. Each chapter nonetheless provides a useful and interesting reference work for recent and former developments in these fields.

The chapter on Biophysical Approaches to Atherosclerosis presents the work of Gofman, a suggestive series of findings which holds promise in the study of blood lipids with the ultracentrifuge. The author offers little criticism, although much might be said about the difficulties of obtaining quantitative results and interpreting data in this field.

In general this volume will be useful, not only to provide information on recent advances, but to obtain a summary of each subject discussed. There is little repetition in the book, which is most commendable. Not devised as a final and authoritative work of great precision, it will serve for quick review and handy reference.

FREDERICK W. BARNES, JR.

PHYSIOLOGISCHE OPTIK. *Handbuch der Experimentalphysik. Band 20, 1.Teil.*

By A. Konig. Akademische Verlagsgesellschaft M. B. H., Leipzig. [*J. S. Edwards, Ann Arbor, Michigan.*] $6.25. viii + 241 pp.; ill. 1929 [1948].

The writing of this volume was originally undertaken by Professor C. Pulfrich. After his death the incomplete manuscript which he left behind was completed by Koenig and published in 1929. As a consequence of the war, copyright became vested in the Attorney General, of the United States in 1945, and republication was permitted in 1948.

Physiological optics is herein defined as the study of visual perception, and consideration of the geometrical optics of the eye is deliberately excluded. The text is an authoritative though somewhat abbreviated summary of the knowledge of visual perception in the 1920's. Current republication is useful, since the original is both out of print and difficult to obtain.

It is perhaps noteworthy of comment that the republication of this work, after a lapse of over 20 years, does not result in a volume largely outdated by recent advances. Perhaps the subjective investigation of the phenomena of visual sensation had already been carried almost to completion at the time of the original publication. Probably the most notable advance in the intervening period was the discovery by Hecht that the visual threshold, under most favorable circumstances, could correspond to the absorption of a single quantum of light by a single rod. On the other hand, if a book were to be published in this field today, it should include the large and rapidly developing fields of the electrophysiology and biochemistry of the retina, and of the analysis of space perception so fruitfully begun by Luneberg. All three of these topics were essentially nonexistent at the time this volume was first published.

JONAS S. FRIEDENWALD

BIOCHEMISTRY

HETEROCYCLIC COMPOUNDS. *Volume I: Three-, Four-, Five-, and Six-Membered Monocyclic Compounds Containing One O, N, and S Atom.*

Edited by Robert C. Elderfield. John Wiley & Sons, New York; Chapman & Hall, London. $11.00. x + 703 pp. 1950.

This first volume of a series presents the chemistry of the monocyclic compounds containing one oxygen, sulfur, or nitrogen atom in 3-, 4-, 5-, and 6-membered rings. The series is planned as a detailed treatment of the chemistry of these compounds, and aims to concentrate on the chemical principles involved rather than to attempt an encyclopedic coverage of the field. Contributions to the present volume are: Ethylene and Trimethylene Oxides (S. Winstein and R. B.

Henderson); Ethylenimine (J. S. Fruton); Derivatives of Azete (S. A. Ballard and D. S. Melstrom); Furan (R. C. Elderfield and T. N. Dodd, Jr.); The Chemistry of Thiophene (F. F. Blicke); The Chemistry of Pyrrole and its Derivatives (A. H. Corwin); Monocyclic Pyrans, Pyrones, Thiapyrans, and Thiapyrones (J. Fried); The Chemistry of the Pyridines and Piperidines (H. S. Mosher). The chemistry of azete was included because of recent interest in the chemistry of the β-lactams in connection with the structure of penicillin. Physiological and pharmacological properties shown by many of the heterocyclic compounds are dealt with concisely.

EVELYN HOWARD

STRUCTURAL CARBOHYDRATE CHEMISTRY.

By E. G. V. Percival. Prentice-Hall, New York (printed in Great Britain). $5.50. viii + 246 pp.; ill. 1950.

This volume is one of the Prentice-Hall Chemistry series, edited by Wendell M. Latimer. The author intended the book to be of service to "students reading for an Honours degree in Chemistry, and to serve as a text book in the later stages of preparation for ordinary and combined degrees," as well as for research workers in both the academic and industrial fields. It is based on the literature up to the early part of 1949, and brings up to date a subject on which the only textbook in English has been Norman Haworth's classic, published in 1928. It is well written and contains an abundance of very clear diagrams of formulae. There are author and subject indices.

EVELYN HOWARD

ORGANIC SYNTHESES. *An Annual Publication of Satisfactory Methods for the Preparation of Organic Chemicals. Volume 30.*

Editor-in-Chief: Arthur C. Cope. John Wiley & Sons, New York; Chapman & Hall, London. $2.50. vi + 115 pp.; ill. 1950.

Methods are given for synthesizing 39 organic substances, including such important biochemical substances as DL-aspartic acid, glutaric acid, and various substituted pyridines.

PROGRESS IN CHROMATOGRAPHY 1938–1947.

By L. Zechmeister. John Wiley & Sons, New York. $8.00. xviii + 368 pp. + 1 pl.; text ill. 1950.

Zechmeister was among the earliest to recognize the high resolving power, great versatility, and analytical usefulness of the technics of selective adsorption. In 1937, in collaboration with L. Cholnoky, he published the first book in this field. This was revised in 1938, and was translated into English in 1941 by A. L. Bacharach and F. A. Robinson. Chromatography has proven to be one of the most effective technics ever discovered for a great variety of problems in chemistry where the separation and estimation of chemical substances having closely similar properties, and especially when but minute quantities are available, as is so often the case in biochemistry. Zechmeister has contributed in a large way to the application of chromatography as an analytical tool and his critical sense in this field is unsurpassed.

The present book is designed to review the literature of chromatography for the years 1938–1947, and is supplementary to the earlier volumes. Almost all of the modifications of technics, theoretical discussions of principles and application of these to a wide variety of substances of plant and animal origin, and a few classes of organic compounds are discussed by the master. There is a bibliography of 40 pages.

Since most of the basic principles were discussed in the first publication, those who desire to be well informed in this field will do well to make themselves familiar with this and proceed to the new volume for more advanced applications and methods. The reader will find there a wealth of specialized information concerning what was accomplished in the decade under consideration.

Zechmeister's interest was stimulated by the work of Tswett, published in 1906, and in his books he has given credit to the Russian botanist for the discovery of the principles of chromatography. In the light of recent historical studies, it will be necessary to rewrite the history of this subject (see History of Chromatography, by H. Weil and T. I. Williams. *Nature, Lond.*, 166: 1000. 1950; 167: 906. 1951). Furthermore, so many new modifications and extensions of technics have been described since 1948 that investigators should seek the more recent publications in order not to overlook important developments which apply to special problems.

E. V. MCCOLLUM

AMINO ACIDS AND PROTEINS. *Cold Spring Harbor Sympos. quant. Biol., Volume XIV.*

Long Island Biological Association, Cold Spring Harbor, Long Island. $7.00. xii + 217 pp. + 11 pl.; text ill. 1950.

This record of the papers presented at the Cold Spring Harbor Symposium of 1949 contains a variety of approaches to the challenge of the proteins. The papers are arranged alphabetically, thus conservatively avoiding any hypotheses as to their content which might prejudice the open-minded seeker of truth. However, after hydrolysis of this rather arbitrary structure, the 22 residues can be classified as consisting

of reports on methodology, of attacks on the problem of molecular structure by means of techniques of organic chemistry, physical chemistry, and x-ray analysis, as well as studies on the metabolism and biosynthesis of amino acids and peptides.

The 4 discussions of promising new methods are: The Fractionation of Proteins by Electrophesis-Convection (J. R. Cann and J. G. Kirkwood); Studies on Polypeptides and Amino Acids by Countercurrent Distribution (L. C. Craig, J. D. Gregory, and G. T. Barry); The Application of the Isotopic Derivative Methods to the Analysis of Proteins (A. S. Keston and S. Udenfriend); and Chromatographic Determination of the Amino Acid Composition of Proteins (W. H. Stein and S. Moore).

D. C. Hodgkin gives an accounting of the evidence from x-ray analysis on protein structure. "While survey work at the different molecular weight steps is still of the greatest importance, . . . one can see that the concentration of effort in the field . . . has shifted very markedly away from further surveying, toward the detailed interpretation of the X-ray data already available. . . . In each of the four main groups of compounds we have examined, we can see that the molecules can in many cases be recognized as consisting of subunits. These subunits are of the same order of magnitude as the molecules of the next lower molecular weight group. . . . There is, from X-ray data, some evidence in favour of the existence of peptide chains in proteins, but . . . at the same time, one must recognize that the organization of many protein molecules is more complex than the organization of peptide chains alone." A curious note is epitomized in the following remark: "If we choose a high molecular weight protein, such as haemoglobin, we cannot observe enough X-ray reflections to show us atoms within the structure and so provide us with our usual criterion of a correct crystal analysis. We ought to consider very carefully what new criteria may be available. (This may not be so important as it seems. There is something about a correct solution to a crystal structure problem to anyone who has gone through the process of finding it, which is often convincing long before the details are properly worked out.)." This seems rather like whistling in the dark by one faced with the application of a rigorous technique to a situation of unprecedented complexity.

K. O. Pedersen presents support for the multiple molecular weight hypothesis, with reasons for supposing that the severe criticisms which this theory has received on the basis of statistical distribution of available molecular weights are not valid because the surveys have been made of molecular weight data which are not representative of the total situation. "Undoubtedly the hypothesis of the multiples is not of such general validity as it at first seemed to be, but it still seems quite possible that we have a limited number of parallel sets of multiple systems each characterized by the specific nature, function, and process of formation of the proteins in question."

K. Linderstrøm-Lang contributes an interesting study of the volume contraction associated with the tryptic breakdown of lactoglobulin, which is too large to be accounted for on the basis of simple cleavage of peptide bonds. He reiterates a warning against being too optimistic about the evidence that proteins have a peptide chain structure. H. B. Bull contributes a study of the molecular weights of the products of protein hydrolysis under various conditions.

R. L. M. Synge reviews physical and chemical studies of granicidin: "It is just the difficulty of interpreting the data obtained with gramicidin, a peptide whose composition is simple and molecular weight low, when compared with typical proteins, that makes gramicidin a very suitable subject for discussion at the present symposium. I have the feeling that some of the difficulties encountered will reappear in future studies with proteins, and, to the extent that this is so, the study of gramicidin will turn out to be of value for the general progress of protein chemistry. . . . Gramicidin, although it can be recrystallized with constant properties, contains at least five components differing in amino acid composition. . . . Although among peptides encountered in nature, the occurrence of families of substances is frequently observed, the case of gramicidin defied detection by a great variety of techniques. . . . One feels that the proteins probably also occur as families of molecules related to one another in structure. . . . If this is so, the present day methods used for the isolation of, and for testing the homogeneity of, 'pure' proteins are totally inadequate for revealing such differences."

F. Sanger presents Some Chemical Investigations of the Structure of Insulin in which he feels he has "demonstrated the presence of three peptide sequences in a hydrolysate of insulin" and concludes that the bovine insulin molecule of molecular weight 12,000 is built up of 4 open polypeptide chains, that are joined together by -S-S bridges.

J. M. Luck presents a study of the formidable problem of the fractionation of the liver proteins; E. L. Smith and L. Rufus consider the interaction of the metal peptidases with their substrates; M. Levy and E. Slobodiansky apply the isotopic derivative technique to the study of protein structures; C. Fromageot contributes a quantitative analysis of amino acids in insulin and lysozyme; and W. L. Hughes presents a study of protein mercaptide formation, the mercury-sulfur bond being much stronger than the bond between mercury and any other grouping commonly found in proteins.

J. S. Fruton and S. Simmonds provide a stimulating review of The Metabolism of Peptides, while S. Emerson contributes Competitive Reactions and Antagonisms in the Biosynthesis of Amino Acids by Neurospora, and D. Shemin discusses some aspects of the

biosynthesis of amino acids in mammals, employing isotopically labelled compounds. P. Zamenčnik and I. D. Frantz present Peptide Bond Synthesis in Normal and Malignant Tissue.

A study of immediate interest to physiologists is that of I. M. Klotz on the nature of some ion-protein complexes, including the kinetics and molecular nature of the binding process, particularly anion binding, in which a net negative charge on the protein does not prevent binding of anions, presumably at positively charged residue sites. An attempt to localize cellular proteins by enzymatic hydrolysis, by B. P. Kaufmann, H. Gay, and M. R. McDonald, has led them to conclude that the chromosome represents an integrated fabric, in which no single protein or nucleic acid may be regarded as the primary structural component. J. F. Danielli contributed a highly preliminary study on the cytochemistry of proteins, so preliminary indeed that it might well have been kept for the next symposium.

EVELYN HOWARD

METABOLISM AND FUNCTION. *A Collection of Papers Dedicated to Otto Meyerhof on the Occasion of His 65th Birthday.*

Edited by D. Nachmansohn. Elsevier Publishing Co., New York, Amsterdam, London, and Brussels. $7.00. vi + 348 pp.; ill. 1950.

In this volume approximately 60 authors dedicated some 40 papers to Otto Meyerhof on his 65th birthday. For the most part, the papers are of a specialized nature dealing with many aspects of the biochemistry of muscle, nerve, and drug action.

AGRICULTURAL CHEMISTRY. *A Reference Text. Volume I: Principles of Agricultural Chemistry.*

Edited by Donald E. H. Frear. D. Van Nostrand Co., New York, Toronto, and London. $9.50. viii + 812 pp.; ill. 1950.

The general scope and intent of this book are expressed in the subtitle, "A Reference Text," and in the Preface, wherein is the following: "For a number of years there has been a need for a reference text on agricultural chemistry. Enrollment of graduate level students . . . has increased phenomenally within recent years. . . . There is also a rapidly increasing number of specialists engaged in agricultural work—county agents, Federal and state extension workers, and representatives of commercial firms—whose work involves the development, promotion, sale or application of such products as feeds, fertilizers, insecticides, fungicides and herbicides. Finally, there is a large body of research investigators in the agricultural sciences who frequently seek information on subjects bordering on their own specialty. All of these individuals have need for a general reference text on agricultural chemistry, and many have expressed the desire for such a book. The first volume of this work deals with the more fundamental phases of agricultural chemistry, including the chemistry of the basic compounds of biological importance, and of the physiological processes of plants and animals. The second volume is devoted to the practical applications of agricultural chemistry."

This book is not an undergraduate textbook; it presupposes considerable knowledge of organic and of biological chemistry in general. In most universities it would hardly be a graduate textbook either, since the graduate courses are specialized—carbohydrates, plant physiology, animal nutrition, soil chemistry, etc. This book has chapters on all of these subjects and more, too. Each chapter is really a monograph, varying in length from 12 to 95 pages, with from 9 to 394 references each. The names of the 22 contributors make an impressive list; they are all recognized authorities in their fields. The editor has done admirably in unifying the whole without marring the individuality of the authors. There are, nevertheless, obvious differences in approach. The chapter on the chemistry of the carbohydrates is extremely compact writing; the material is so concise and condensed that it seems to crystallize. The chapters on vitamins, in contrast, takes it easier, and is more of a story. All of the expected topics in a work on agricultural chemistry are here. Part I deals with the chemistry of carbohydrates, lipids, and proteins; Part II, with fundamental processes of enzyme action, biological oxidations, biophysics; Part III, with plant chemistry, metabolism, inorganic substances, photosynthesis, pigments, carbohydrate and nitrogen metabolism, hormones; Part IV, with animal chemistry, digestion, energy exchange, metabolism of carbohydrates, lipids and proteins, inorganic substances, vitamins; and Part V, with minerals, colloids, and organic matter in soils. If you need an authoritative reference book on all phases of agricultural chemistry, this book will no doubt fill that need. Printing, paper, drawings, formulas, and tables are excellent.

J. J. WILLAMAN

THE ESSENTIAL OILS. *Volume One: History, Origin in Plants, Production, Analysis. Second Printing.*

By Ernest Guenther. D. Van Nostrand Co., New York, Toronto, and London. $6.00. xvi + 437 pp.; ill. 1948.

THE ESSENTIAL OILS. *Volume Two: The Constituents of Essential Oils.*

By Ernest Guenther and Darrell Althausen. D. Van Nostrand Co., New York, Toronto, and London. $10.00. xiv + 852 pp. + 1 folding table. 1949.

THE ESSENTIAL OILS. *Volume Three: Individual Essential Oils of the Plant Families Rutaceae and Labiatae.*
By Ernest Guenther. D. Van Nostrand Co., New York, Toronto, and London. $10.00. xvi + 777 pp.; ill. 1949.

THE ESSENTIAL OILS. *Volume Four: Individual Essential Oils of the Plant Families Gramineae, Lauraceae, Burseraceae, Myrtaceae, Umbelliferae and Geraniaceae.*
By Ernest Guenther. D. Van Nostrand Co., New York, Toronto and London. $12.00. xiv + 752 pp.; ill. 1950.

As studies of animal-plant relationships, and plant physiology generally, have progressed in the last three decades, biologists have felt an increasing need for more basic information concerning plant chemistry. The chief repositories of such facts have been the volumes on essential oils by Gildemeister and Hoffmann, Finnemore, and Parry, and the more general works of Czapek and of Wehmer. While these were excellent treatises, they contained many gaps which have since been filled through the continuing efforts of plant chemists. The present monumental work by Guenther represents a successful effort to bring certain phases of the subject up to date.

Although essential oils are by definition the volatile oils of plant origin in contradistinction to the less volatile fatty oils, the oil components include a wide variety of chemically unrelated compounds. Thus this work treats of a greater array of chemicals of plant origin than the title might indicate to the uninitiated. Originally intended for use by the essential oil industry, the work constitutes a rich source of information for the biologist. For example, Volume I, in addition to discussing the history of the essential oil industry and the methods of oil production, contains a valuable chapter on the chemistry of the oils, their genesis in the plant, and their function in the plant. Also of considerable interest is the chapter devoted to the examination and analysis of oils. This volume contains in addition a list of supplementary literature, tables of boiling points, and conversion tables. Volume II is devoted to the constituents of the essential oils. Data on several hundred of the most important natural constituents have been assembled here in the form of monographs. Structural formulae, occurrence, methods of isolation and identification, and physicochemical properties are given. The 12 grand divisions include: Hydrocarbons; Alcohols; Aldehydes; Ketones; Phenols and Phenol Ethers; Quinones; Acids; Esters; Lactones, Coumarins, Coumarones; Furan Derivatives; Oxides; Compounds Containing Nitrogen and Sulfur. The volume concludes with a section on Terpenes, Sesquiterpenes, and Derivatives of Unknown Constitution, and another on the Preparation of Derivatives of Essential Oil Constituents.

The succeeding volumes will consist of monographs on individual oils, describing their botanical and geographical origin, methods of cultivation of the plants from which they are derived, techniques of distillation and yield of oil, their physico-chemical properties, chemical composition, total production, and uses in industry. The plan of treatment followed is based upon plant families, and the families are arranged in order of the commercial importance of their oils. Volume III treats of the Rutaceae and Labiatae. Because of the practical necessity of restricting the scope of the work, data on many experimental oils (i.e., those produced on an experimental basis and those about which information is contradictory) have been omitted. Thus, while this volume is intended for practical use by the industry, it still contains much information of value to biologists. Volume IV, which follows the same plan as the preceding volume, treats of the oils of the Gramineae, Lauraceae, Burseraceae, Myrtaceae, Umbelliferae, and Geraniaceae. Each volume contains generous lists of references at the ends of sections as well as lists of suggested reading. Volume II gives the structural formulae of most of the compounds discussed, and all volumes contain a great amount of tabular material. Volumes I, III, and IV are adequately supplied with illustrations depicting various aspects of plant cultivation and oil processing. The halftones are of poor quality. In all other respects the books are excellent.

From the point of view of the biologist interested in plant chemistry, volumes I and II of this series will undoubtedly prove the most useful. The remaining volumes will serve chiefly as reference works for details concerning specific families.

V. G. DETHIER

APPLES AND APPLE PRODUCTS. *Economic Crops, Volume II.*
By R. M. Smock and A. M. Neubert. Interscience Publishers, New York. $7.80. xvi + 486 pp.; ill. 1950.

This is Volume II of a series of monographs on the chemistry, physiology, and technology of food and food products. While the subject is one of undoubted interest to the food technologist, it possesses aspects of considerable value to the biologist. Especially pertinent in this respect are the chapters devoted to The Development and Structure of the Apple Fruit, Some Environmental and Cultural Factors Affecting the Chemical Composition and Physiology of Apples, Chemical Changes and Physiology of Apple Fruit on the Tree, and Chemical Changes and Physiology of Apple Fruit After Harvest. Much useful information has been gathered from a scattered literature and is presented clearly and concisely. The volume is very well documented and contains a profusion of graphs and tables.

V. G. DETHIER

HORMONE ASSAY.

Edited by C. W. Emmens. Academic Press, New York. $10.00. xii + 556 pp.; ill. 1950.

Some 14 investigators of reputation contributed the 20 chapters of this volume, the result being a collection of many of the important chemical and biological methods for assaying hormones. The chapters on statistical methods, estrogens and hormones of the corpus luteum were written by the editor. C. W. Turner wrote 2 chapters, one on the Thyrotropic Hormone and one on the Mammogenic Hormone. Together with J. Meites, he prepared a chapter on the Lactogenic Hormone and also, with E. P. Reineke, he contributed a chapter on Thyroidal Substances. R. H. Thorp was responsible for 2 chapters, on the Para-Thyroid Hormone and the Posterior Pituitary Lobe Hormones. R. I. Dorfman contributed 2 chapters, one on the Androgens and the other on Adrenal Cortical Hormones. The Berkeley group of Greenspan, Li, Simpson, and Evans did a section on the Growth Hormone and another on Adrenocorticotropin. C. B. West discusses the Biological and Chemical Assay of Adrenalin; K. L. Smith, Insulin; C. Hamburger, Gonadotropine; R. K. Callow, Steroids of the Androgen and Adrenocortical Hormone Groups; R. Pitt-Rivers, Thyroxine and other substances with Thyroidal Activity; G. A. D. Haslewood, Estrogens and Pregnanesterol; and F. W. Landgrebe and H. Waring wrote the chapter on the Assay of the Melanophore Expanding Hormone from the Pituitary. This volume will be an excellent companion to the 2-volume survey recently edited by Pincus and Thimann: *The Hormones, Physiology, Chemistry and Application.*

DAVID B. TYLER

LABORATORY MANUAL FOR PHARMACOGNOSY. *Second Edition.*

By Edward P. Claus. C. V. Mosby Co., St. Louis. $3.25 (paper). 111 pp. + "Outline for Study" pages. 1950.

A series of exercises designed to teach the student of pharmacy the methods employed to determine the identity and quality of vegetable drugs and products of natural origin.

C. JELLEFF CARR

THE TECHNOLOGY AND CHEMISTRY OF ALKALOIDS.

By Frank E. Hammerslag. D. Van Nostrand Co., New York, Toronto, and London. $6.50. viii + 319 pp.; ill. 1950.

This book is principally designed for those engaged in the manufacture of alkaloids, the emphasis being on manufacture. Although the chemical treatment of the various alkaloids is very adequate, it is of necessity limited by the purpose of the book. Some 20 alkaloids are discussed from the standpoint of their Chemistry, Natural Sources, Manufacturing Methods, Pharmacological Properties and Therapeutic Uses, and Analytical Methods. The book is exceptionally well written and organized, and contains a very adequate index and bibliography.

DAVID B. TYLER

PRINCIPLES OF CHEMISTRY. *An Introductory Textbook of Inorganic, Organic, and Physiological Chemistry for Nurses and Students of Home Economics and Applied Chemistry. Seventh Edition.*

By Joseph H. Roe. C. V. Mosby Co., St. Louis. $3.50. 427 pp. + 4 pl.; text ill. 1950.

This very unusual introduction to chemistry is prepared for the training of nurses. It includes not only sections on fundamental concepts and on inorganic chemistry, but also sections on organic chemistry (4 chapters); carbohydrates, proteins, and fats (3 chapters); catalysis, enzymes, and digestion (2 chapters); metabolism (2 chapters); the chemistry of excretion (1 chapter); the blood and respiration (2 chapters); milk and foods (2 chapters); and vitamins and hormones (2 chapters). Although the discussion is extremely elementary, its breadth makes it very suitable for the purpose for which it is intended. In the new edition material has been added to bring the topics up-to-date. Even vitamin B_{12} has been included, although cortisone and ACTH have yet to be introduced.

REPORTS OF THE BIOCHEMICAL RESEARCH FOUNDATION OF THE FRANKLIN INSTITUTE. *Vol. X—1948–1949. With an Index to BRF Publications Nos. 1 to 242 and BRF Notes, Nov. 1938 to Dec. 1949. Bound in Repts. biochem. Res. Found., Vols. I–X, 1930–1949.*

Director: Ellice McDonald. Advisory Committee: Henry Butler Allen, Robert B. Flint, William A. Mosher, Stuart Mudd, Leonard G. Rowntree, and W. F. G. Swann. Biochemical Research Foundation, Newark, Del. Free upon request.

MICROBIOLOGY

AN INTRODUCTION TO THE STUDY OF VIRUSES.

By Kenneth M. Smith. Pitman Publishing Corp., New York, Toronto, and London. $2.50. x + 106 pp. + 16 pl. 1950.

As the author indicates, the subject of virology has largely been divided up into artificial compartments having to do with plant viruses, animal viruses, and bacteriophages. Although many students of bacterio-

phage have had considerable familiarity with animal viruses, the barriers between these areas and that of plant viruses have rarely been breached. This book is an attempt to survey the entire field, without exhaustive treatment of any one subject, but in such a way that relationships between the viruses in the different compartments will become evident. This has been accomplished, at least to a degree, in an interesting and delightful manner. As might be expected in a book written by an author who has devoted himself mainly to the study of plant viruses, much of the material presented is from that field.

In a short introductory chapter the author has interwoven the history of the 3 fields of virus study, indicating many principal landmarks of each. The second chapter deals with the transmission and spread of viruses and draws interesting analogies between the transmission of certain animal and plant viruses by direct or indirect contact, in both cases slight damage to epithelial surfaces being necessary. Similar comparisons are made in the discussion of the transmission by inheritance or grafting, and in the activation of "silent" viruses. The bulk of the discussion on transmission, however, is reserved for Chapter 3, which deals with arthropod vectors, a subject of importance in reference to viruses of both plants and animals.

Chapter 4 is devoted to brief descriptions of representative virus diseases, those chosen from the plant field being the tobacco mosaic, ring-spot, distortion disease, enation, and wound tumor viruses. Among the animal viruses, those of foot-and-mouth disease, dog distemper, fowl pox and fowl-pest, certain fowl tumors, infectious papillomatosis of rabbits, a tumor virus of the frog, and various insect viruses are included. The survey concludes with a short account of the "disease," bacteriophagy.

Chapter 5 describes the isolation and purification of some representative viruses and Chapter 6 reports the physical and chemical properties of those that have been studied to the greatest extent. Tabulations of the size of virus particles and their chemical composition are included in this chapter. The electron microscopy of viruses is treated in chapter 7 which includes a separate signature on which 16 half-tone engravings are printed. Chapter 8 describes certain serological reactions used in virus study, with most of the examples taken from the study of plant viruses. A final chapter on the control of virus diseases illustrates the various principles that can be applied and indicates how they relate to the plant and animal viruses. References by chapters are gathered together at the end of the book and a brief index is included.

The value of this book lies in its capacity to stimulate and broaden rather than to convey detailed information. It is to be hoped that solutions to problems in the animal virus field may be found by concepts or methods of attack more familiar to the plant disease field, and vice versa. This small volume may be expected to assist in that approach to the study of virology.

F. B. GORDON

VIRUS. *Eine kurze Zusammenfassung der Kenntnisse über das Virusproblem.*

By Helmut Ruska. Stahlberg-Verlag, Karlsruhe. DM 4.50 63 pp. + 1 folding table; text ill. 1950.

This excellent, concise review of the newer knowledge of viruses will be included in Bertalanffy's *Handbuch der Biologie*, but because of the lack of a short compilation on modern developments in virology in the German literature it was separately published prior to release of the complete volume. Intended for biologists and physicians, this outstanding volume includes a wealth of information in just 62 pages. Beautiful illustrations and well planned tables minimize lengthy description. The work is divided into 8 short chapters, including a review of diseases of plants, animals, and man, bacteriophage, research techniques, and morphology and chemistry of viruses. It is to be hoped that an English translation may be made available to biologists and physicians of this country.

ROBERT J. GOODLOW

INTRODUCTION TO THE BACTERIA.

By C. E. Clifton. McGraw-Hill Book Co., New York, Toronto, and London. $5.00. xii + 528 pp. 1950.

As its title indicates, this is an introductory textbook of general bacteriology. Broad in scope, it approaches the subject from a basic and fundamental viewpoint, and is more comprehensive than many conventional textbooks. Descriptive bacteriology is not emphasized. The general properties and classification of bacteria are considered in relation to other microorganisms. The physiology of bacteria, soil bacteriology and natural economy, public health and sanitary bacteriology, industrial microbiology, and the microbiology of infectious disease are discussed.

HARRIETTE D. VERA

BAKTERIOLOGIE UND SEROLOGIE. *Ausgewählte Untersuchungsmethoden für das Bakteriologische und Serologische Laboratorium.*

By Lothar Hallmann. Georg Thieme, Stuttgart. DM 29.70, $7.00. xii + 644 pp.; ill. 1950.

A short introductory chapter of this book gives comprehensive definitions of the technical terms used in bacteriology. The main part of the book consists of a well-written description of routine methods for the diagnosis of pathogenic bacteria, rickettsiae, viruses,

fungi, and protozoa; the text is provided with numerous illustrations, many of them in color. A second part of the book contains directions for serological analysis and for general techniques such as sterilization, cultivation, and examination of food. An appendix, printed on colored paper, contains recipes for stain solutions and special media. While the text is lucid and sufficient for routine work, no attempt is made to describe scientific precision methods, such as the determination of antibodies by gravimetric or Kjeldahl analyses. Typographically the book meets the highest standards; paper and print are excellent; the finding of directions is facilitated by the extensive use of different type sizes and by numerous headings and subheadings for chapters and paragraphs. The cover of the book is washable linen. The book is to be recommended highly as a dependable manual for the routine work in bacteriological laboratories.

FELIX HAUROWITZ

LABORATORY MANUAL OF INDUSTRIAL MICROBIOLOGY. *By Cecil Gordon Dunn. Massachusetts Institute of Technology, Cambridge.* $2.50 (paper). viii + 192 pp. 1950.

This manual (in offset lithography, with plastic comb binder) contains 47 laboratory exercises in industrial microbiology. Being printed on both sides of each page, it is intended for use with a separate notebook. It is smaller than most similar works, and will fit into the coat pocket. Each exercise is followed by a number of questions, as well as references to texts, patents, or articles in journals. Most of the exercises are of the conventional sort, but several (such as the fermentation of milk with *Torula cremoris* to give ethyl alcohol) strike an interesting note of novelty. The work will merit careful consideration by those interested in giving a laboratory course in microbiology.

WALTER C. TOBIE

CANNED FOODS. *An Introduction to Their Microbiology. Third Edition.*

By J. G. Baumgartner; foreword by W. Clayton. D. Van Nostrand Co., New York. x + 278 pp.; ill. 1949.

Canning microbiologists as well as food technologists in general will find this little book of value as a ready source of much information on the many aspects of food canning. The book succeeds well in stating the principles involved in the processing of canned foods. In addition, it gives the common causes of spoilage and the methods of control. Although the 1st edition appeared only 6 years ago, the present one is considerably larger and more comprehensive. This 3rd edition differs from the 2nd by the inclusion of a chapter on the sources and control of microbial contamination. Also, a new chapter has been formed through the enlargement and revision of the section on the effects of heat on microorganisms. Several new diagrams and illustrations have been added. The references are adequate, the format good. Spelling and word choice in some instances are not in accord with accepted usage. For example, such terms as levulose, dextrose, albumen, and sulphur appear several times. The effects of different canning processes on the nutritional qualities of foods are not discussed.

HARRY G. DAY

AN INTRODUCTION TO THE MICROBIOLOGY OF WATER AND SEWAGE FOR ENGINEERING STUDENTS. *Revised Edition.*

By P. L. Gainey and Thomas H. Lord. Burgess Publishing Co., Minneapolis. $3.50. viii + 319 pp. 1950.

Civil, sanitary, and public health engineers need a considerable background in sanitary biology. The construction and operation of large works, the water and food supply, waste disposal, and housekeeping of camps, municipalities, and large industries require a sound working knowledge of the control of communicable disease. The decrease in epidemic intestinal disease, until recently a large wasting factor in all large human operations, is largely due to the development of this knowledge within the engineering and associated professions.

The intent of this book is to furnish a text outline and laboratory direction book for an undergraduate course in public health biology for engineers. These notes were developed from actual courses given in the department of biology of Kansas State College over a number of years. Such courses for engineers have been and are currently given in other departments of biology in other universities to meet the needs of undergraduate sanitary and public health engineers. In choosing this book as a basic textbook and outline for such an interdepartmental course, it is reasonably certain that engineers, particularly sanitary majors, will prefer more professional coherence than is indicated in these notes. This is undoubtedly furnished by the authors in their lectures and demonstrations. It will be required of any biologist who uses the book as a working text.

There are a number of disadvantages in the sort of interdepartmental arrangement for teaching specialized courses that show up clearly here. This textbook is obviously practical, and everything about it shows conformity to the demands of scheduled and limited time, to the need for handling large classes with short personnel and equipment, and to the requirement that the experiment shall always succeed. This is the sort of problem that any teaching member of a biology depart-

ment, carrying several other courses with their laboratory requirements and other responsibilities, faces when the engineering school asks him to provide a course for its students.

In spite of the best intentions, there is not the time and extra energy needed to keep abreast of the rapid developments in public health, water resources, waste disposal, applied bacteriology, and other professional fields. As a result, what appears here, and what is taught in such courses is well behind what is practiced in the best water works and sewage disposal plants, in public health laboratories, and in good sanitary engineering departments. An example is furnished by the very inadequate development of chlorine disinfection of water supplies, particularly in the laboratory exercises. Only once is the orthotolidine test for chlorine used, and the explanation is limited. The several more critical analyses with which any apprentice sanitary engineer must be familiar—the orthotolidine arsenite test, the "flash" test, the Moore test, and the corrections for chloramine and for interfering substances are not given.

Again, the estimation of small numbers of coliform bacteria in treated waters is limited to a supplemental exercise, because, it is pointed out, the demands for glassware and space are so great that large classes cannot perform the standard "most probable number" by dilution measurement. Sanitary engineers would argue that an understanding of the theory of most probable numbers is essential to the appreciation of quantitative bacteriological data, and that the technical facility developed in the repeated performance of a number of dilution counts is basic training for the man who is sent out to examine a water works system.

Here, roughly, is the fundamental difficulty; the measurements made in the laboratory exercises are not in units that engineers would use in determining the efficiencies of water or waste treatment. The exercises are primarily demonstrations, and like many chemistry and biology laboratory "experiments" the conclusions are evident from the beginning. They do not present problems of the order that young engineers are required to solve.

CHARLES E. RENN

PRACTICAL DAIRY BACTERIOLOGY.

By Paul R. Elliker. McGraw-Hill Book Co., New York, Toronto, and London. $4.00. x + 391 pp.; ill. 1949.

This book was written for winter-course students. In evaluating it, it must be kept in mind that it is meant for readers with a quite limited knowledge of chemistry and biology. The first 50 pages represent an introduction to general bacteriology without emphasis on dairying. This is followed by 61 pages on standard methods used to determine the sanitary quality of milk and dairy products. The second part deals with the manufacture of dairy products for human consumption. A chapter on market milk (38 pp.) starts with a bacteriological study of the milking process by hand and by milking machines, the various sources of milk contamination, cooling, pasteurization, the grading of milk, and a brief discussion of the diseases transmitted by milk. The chapter on butter tells about the several types of butter, their manufacture, their keeping qualities and spoilage types. A chapter on cheese (51 pp.) describes the manufacture of each type, with emphasis on cheddar and Swiss cheeses. A short chapter on fermented milk ends the part where bacterial activity is an essential phase of manufacture. Dairy starters (pure cultures) are treated in a separate chapter. Then follow chapters on condensed milk, milk powder, ice cream—where any bacterial action whatever is undesirable and prevented by various means. The book ends with quite an extensive (52 pp.) and very necessary chapter about the cleaning of dairy equipment.

It would seem desirable to have more detail given in the chapter on general bacteriology. However, the author may have realized that short-course students generally are interested mostly in the purely applied side of science. Once in a while, explanations seem insufficient. The statement that "a disease-producing bacterium produces enzymes that enable it to live on a certain animal or plant host" is not likely to give the student a good conception of enzymes. The statement that "the highest possible moisture content usually is the optimum for bacteria, yeasts, and molds," does not take into consideration that most species grow better in milk than in diluted milk; the highest possible moisture content is 100%, i.e., distilled water.

The meaning of pH is not explained. For the class of readers for which this book is meant, that would have required a very extensive treatise on physical chemistry and, therefore, no attempt was made. The facts are merely presented without explanation.

The text of the chapters on manufacture is clear and precise. In the chapter on Cheese Manufacture, each type is described, then its manufacture is given in considerable detail, and with the more common types, the common defects and their causes are mentioned.

Some of the pictures of the microorganisms are not very clear or illustrative of the descriptions in the text. The figures for the manufacturing part are good.

OTTO RAHN

LABORATORY MANUAL FOR DAIRY MICROBIOLOGY.

By E. M. Foster and W. C. Frazier. Burgess Publishing Co., Minneapolis. $1.75 (paper). iv + 59 pp. 1950.

This manual contains 29 laboratory exercises to be given in periods of 2 hours each. The directions are simple and direct. Each exercise is followed by a number of

questions and a few references. The manual is clearly mimeoprinted on one side of the paper, and has a spiral wire binder. The manual seems primarily intended for use by the authors' classes at the University of Wisconsin. Most of the experiments are based upon their previous manual of 1948, but several are based upon their *Standard Methods for the Examination of Dairy Products*, 9th edition, 1948. Others interested in dairy bacteriology will quite possibly find this a useful laboratory manual.

WALTER C. TOBIE

VETERINARY BACTERIOLOGY AND VIROLOGY. *Fourth Edition.*

By Ival Arthur Merchant. Iowa State College Press, Ames. $8.50. viii + 885 pp.; ill. 1950.

This book has 4 parts: (1) general biology of microorganisms; (2) infection, resistance, and immunity; (3) classification and characteristics of pathological bacteria, yeasts, and molds; and (4) the filterable viruses and bacteriophages.

Much of Parts 1 and 2 are so general as to be hardly understandable to the beginning bacteriology student and yet so elementary as to be of little value to the advanced student. In view of the character of these two sections, more comprehensive bibliographies would be desirable. On the other hand, most of the chapters in Parts 3 and 4 are excellent. They are well organized, give technical details of the bacteriological and serological differentiation of related organisms and discuss the pathological significance of the organisms. These sections of the book can well be recommended both as a reference for the practitioner of veterinary medicine and as a guide book for the laboratory worker in the field.

ELAINE L. UPDYKE

SURFACE-ACTIVE QUATERNARY AMMONIUM GERMICIDES.

By Carl A. Lawrence. Academic Press, New York. $6.00. viii + 245 pp. 1950.

This comprehensive review can be very highly recommended to persons wishing to make an effective use of the surface-active quaternary ammonium germicides. It is also an indispensable reference work for those doing research in this field. The views expressed in the original papers are given careful and comprehensive scrutiny, and important differences in opinion on controversial aspects are pointed out. Trade and chemical names of a large number of the agents are given. It is regrettable that the 550 references are not given in alphabetical order of the names of the senior authors of the papers, but are listed in the order in which the papers are first mentioned in the text. However, by means of the author index it is possible to locate a given contributor not only in the references but also in the text. A few errors were noted, minor flaws in what is otherwise an admirable piece of work.

WALTER C. TOBIE

BACILLES TUBERCULEUX ET PARATUBERCULEUX. *Bactériologie. Chimie Antibiotiques. Chimiothérapie.*

By P. Hauduroy, with MM. E. Chain, Howard Florey, K. A. Jensen, G. Penso, J. Tréfouël and A. Q. Wells. Masson & Cie., Paris. 850 fr. 185 pp.; ill. 1950.

This work presents a series of critical reviews: L'activité biologique des substances extraites du bacille tuberculeux (E. Chain); Les antibiotiques actifs contre le bacille tuberculeux (Howard Florey); L'acido-alcoole-résistance des bacilles tuberculeux et paratuberculeux (Paul Hauduroy); Les types humain et bovin du bacille tuberculeux (K. A. Jensen); Les bacilles paratuberculeux (Giuseppe Penso); Les agents chimiothérapeutiques actifs contre le bacille tuberculeux (Jacques Tréfouël); Le type murin du bacille tuberculeux (A. Q. Wells).

The illustrations are excellent, and the bibliographies to each paper are very extensive. Clinical and laboratory workers in the field of tuberculosis will find this work to be of great value.

WALTER C. TOBIE

BACTERIOLOGICAL TECHNIQUE. *A Guide for Medical Laboratory Technicians.*

By Wallace W. W. McEwen; with a foreword by Professor Sir Alexander Fleming. Chemical Publishing Co., Brooklyn, N. Y. $4.50. viii + 293 pp.; ill. 1950.

As Sir Alexander Fleming comments in a Foreword, this book is designed specifically for the medical laboratory technician, and it gives many elementary details. Many routine cultural and microscopic methods in clinical bacteriology are reviewed.

TECHNIQUE DE MICROMANIPULATION. *Monographies de l'Institut Pasteur.*

By Pierre de Fonbrune. Masson et Cie., Paris. 700 fr. (paper). 203 pp.; ill. 1949.

This book is not, as the title implies, a generalized work, but a minutely detailed manual for use with the author's pneumatic micromanipulator and microforge, instruments which have been available commercially for nearly 20 years. In the manipulator the needleholder is activated by 3 aneroid diaphragms which are at right angles to one another and are controlled by a corresponding assembly of 3 pneumatic pumps, activated by

a single lever. As in the Chambers manipulator, the needle tip describes arcs of low curvature and, somewhat as in the Emerson manipulator, the movements of the control lever correspond in direction to the apparent movements of the needle under the microscope. Further claimed advantages of the pneumatic system are rapidity of response, absence of vibration transmitted from the hands, and lack of play, though the last point seems dubious, since the pump pistons are mechanically linked to the control lever.

The microforge is an even more intricate device, consisting of a horizontal microscope with a controlled heat filament, mechanical levers, and air jets to cool the work or to blow the glass into various shapes. Pipettes are drawn by the relatively crude process of hanging a weight on capillary stock which is heated on one side. The microforge appears to be the instrument *par excellence* for the construction of individual microspatulas, needles and pipettes of all types, loops, bulbs, hooks, scalpels, electrodes, etc., but would be by no means as convenient for making numbers of duplicate needles or pipettes for routine work, as, for example, the Livingston machine. The directions for operating the microforge contain a considerable amount of material of general interest in working capillary glass at various temperatures.

The examples given of the use of the manipulator are few, and disappointingly routine, e.g., injection into amoebae; isolation of single bacteria; and the fact that there are practically no citations in the bibliography which refer to actual research done with the instrument is surprising in view of its apparent mechanical advantages. Possibly its necessarily high cost is to blame. It is likewise disappointing not to have any concrete examples given of the uses for the extraordinary instruments which can be fabricated with the microforge. From my own experience it is to be suspected that the sticky interior of the living cell renders useless all but the simplest types of needles, and this suspicion is supported by the fact that the single example of "microsurgery" described—the intercellular transfer of a nucleus—is performed by impaling the nucleus on a straight needle and forcing it out of one amoeba and into the other. The microforge, however, might be ideal for constructing devices for microengraving or for delicate physical or instrumentative work.

JOHN B. BUCK

PARASITOLOGY

THE SNAIL HOSTS OF BILHARZIA IN AFRICA—*Their Occurrence and Destruction.*

By Alan Mozley. H. K. Lewis & Co., London. 9s. viii + 78 pp.; ill. 1951.

This little primer of health in Africa is a necessity for any resident in any part of that continent who is interested in the health of the community or of the individual, as well as for any visitor dreading disease more than the attacks of wild animals.

Bilharzia, or schistosomiasis, is a debilitating disease caused by certain flatworms in the blood vessels. It is fatal after many years unless properly treated. It is by no means confined to Africa but is prevalent all around the world in southern latitudes, even in Europe. The parasites live alternately in man and in certain fresh-water snails. Hence the author, a malacologist with wide experience with aquatic snails the world over, has written this booklet to show just what snails in Africa carry this disease and how to exterminate them, as the best method of checking the disease. Of the many water snails in Africa only 4 species carry this disease. Some carry the parasites that live in the kidneys, and others those that live in the blood vessels of the bowels.

The author provides an interesting table to enable anyone to be reasonably sure that the snails he may suspect as carrying the disease are really harmless; but to make sure of a harmful species, he is advised to consult a specialist.

The eggs of these parasites pass from man in urine or feces into damp places or into water. In fresh water they hatch and swim as minute ciliated creatures, and soon perish, unless they can find and enter the right species of snail. There they multiply and then escape into the water again. This time they swim about as minute larvae with tails (cercariae) and soon die unless they get into human beings. This they readily do by entering any part of the skin, even of a finger dipped into the infected water; or else they enter by the mouth when the water is drunk or when it is used in washing lettuce, etc. While the life of the parasite in the water is brief, new ones may be introduced at any time, so that eventually they manage to infect man. Thus when a European family left their sterile bathing pool for a vacation, every one of them became infected upon return, since a gardener's boy with bilharzia had bathed there meanwhile.

The author shows photographs of the four host snails as well as of innocent ones, and also of localities that may be sources of infection. Of local interest are the pages which describe the diverse kinds of pools and streams in Africa and explain how to tell the dangerous from the innocuous, and how to look for the dangerous snails.

A very important section deals with the means of killing off the dangerous snails, as by increasing their enemies (ducks), by draining, through control of vegetation, treatment of water with various organic substances found in leaves and flowers or other chemicals, of which the best are copper compounds. Snails are so sensitive to copper that they die when a copper coin is put into an aquarium with them! Copper salts used in great dilution are found not to injure man.

The small book ends with directions for applying certain copper salts to infected water and closes with

the remark: "The losses from Bilharzia are not to be measured only by deaths directly caused by the disease, but also by its inevitable concomitants,—laziness, inefficiency, and vaguely defined ill-health. Wherever Bilharzia is ravishing, man must act and act now."

E. A. ANDREWS

HUMAN HELMINTHOLOGY. *A Manual for Physicians, Sanitarians, and Medical Zoologists. Third Edition, thoroughly revised.*

By Ernest Carroll Faust. Lea & Febiger, Philadelphia. $10.00. 744 pp.; ill. 1949.

This new edition of *Human Helminthology* has been thoroughly revised and includes a considerable amount of information that accumulated during World War II on helminths of man, e.g., Bancroft's filariasis and schistosomiasis japonica. The volume is divided into 7 sections containing a varying number of chapters. Section headings are: Scope of Helminthology, Platyminthes, Acanthocephala, Nematoda, Nematomorpha, Annelida, and Technical Aids in the Diagnosis and Treatment of Helminthic Infections. The first section includes a very useful glossary of zoological and medical terms and 2 new chapters dealing with the pathogenesis and clinical aspects and control of helminthic infections. The section on the Annelida is new and is comprised of a chapter on the leeches. As in former editions, the more important helminths parasitizing man are dealt with as to taxonomy, historical data, geographical distribution, structure and life cycle, epidemiology, pathogenesis, pathology and symptomatology, diagnosis, therapeusis, prognosis, and control.

New methods of collecting, preparing, preserving, and identifying helminthic materials are included in the final section, and the chapter on anthelminthics and their use is up to date. There is a discussion of the drugs that were found to be of value in the treatment of schistosomiasis and filariasis acquired by military forces in the Pacific, 1942–45. The volume closes with a fairly extensive and conveniently arranged bibliography of the important literature on human helminthology.

Once again Faust has given us an authoritative, well organized, clearly written and well illustrated manual. Due to the scope of the treatment this book will be useful to the physician, the public health worker, and the medical zoologist.

M. S. FERGUSON

MEDICAL PARASITOLOGY *for Medical Students and Practicing Physicians.*

By William G. Savitz. The Blakiston Co., Philadelphia and Toronto. $4.25. xii + 296 pp. + 1 pl.; text ill. 1950.

This is intended as a lecture and laboratory guide for medical students and others taking medical parasitology, and the author intended it to supplement textbooks in parasitology. The emphasis is medical rather than zoological; the appendix discusses certain laboratory techniques. The illustrations are adequate, it contains a vocabulary of technical terms, and is fairly well indexed but contains no bibliography.

DAVID B. TYLER

AN ILLUSTRATED LABORATORY MANUAL OF PARASITOLOGY. *Revised Edition.*

By Raymond M. Cable. Burgess Publishing Co., Minneapolis. $2.25 (paper). ix + 152 pp.; ill. 1950.

Most individuals who are concerned with the teaching of parasitilogy are familiar with this laboratory manual, which first appeared in 1940. Although it has undergone previous revisions and reprintings, the present revision is the most extensive. It has been materially reorganized, rewritten, and expanded. The number of pages now totals 152 as compared to 112 in the 1946 printing. The present edition has maintained the same major parts of the manual. One is devoted to each of the 3 fields of parasitology, and two others respectively to a general introduction, and to laboratory techniques. It provides a detailed guide to the student taking a laboratory course in parasitology. The text includes specific directions and questions to assist and stimulate the student. The clear offset printing, numerous line drawings, and spiral wire binding add greatly to its usefulness as a laboratory manual. It will undoubtedly continue to be one of the most popular for college courses in parasitology that emphasize the parasites of man.

M. M. BROOKE

HEALTH AND DISEASE

MAN, MICROBE AND MALADY. *Revised Edition. Pelican Book.*

By John Drew. Penguin Books, Harmondsworth, Middlesex; Baltimore. 35 cents (paper). 209 pp. + 8 pl. 1950.

This number of the Pelican Books series gives an excellent over-all presentation of pathogenic bacteriology for the intelligent general reader. First published in 1940, it was reviewed in *Q.R.B.* 16: 238. 1941. The present issue is designated a reprinting, but might be regarded as a second edition, since new material (such as antibiotics) has been included. Specialists may differ with some of the interpretations, but in general the book can be highly recommended.

WALTER C. TOBIE

COMMUNITY HEALTH. *Third Edition.*

By Laurence B. Chenoweth and Whitelaw Reid Morrison. Appleton-Century-Crofts, New York. $3.00. xii + 314 pp.; ill. 1949.

This is a brief elementary textbook for college courses in public health. To cover so broad a field, selection of material is difficult and omissions are necessary. Students might prefer, however, to have less emphasis on infectious disease (nearly two-thirds of the book) and to have other subjects discussed, such as, for instance, mental health, international health problems and housing. The chapters on accidents and difficult health problems, which include heart disease and cancer, are timely. The book has many illustrations, useful references and a good glossary.

HARRIETTE D. VERA

HEALTH GUIDES AND GUARDS. *Fourth Edition.*

By Francis P. Wall and Louis D. Zeidberg. Prentice-Hall, New York. $3.00. x + 390 pp.; ill. 1949.

This is a very elementary and non-technical book covering both personal and community hygiene. Personal hygiene is discussed in a series of chapters on the body systems. Separate chapters are devoted to syphilis, gonorrhea, and chancroid. The chapters on community hygiene deal with infectious diseases, sanitation and public health administration. Some of the more social aspects and fundamental problems of public health are barely mentioned or omitted—for example, mental health and international health problems. There is a chapter on first aid, but no discussion of accidents or safety measures, a subject which surely has primary importance in the guiding and guarding of human life and health.

HARRIETTE D. VERA

ANIMAL SANITATION AND DISEASE CONTROL. *Revised and Enlarged.*

By R. R. Dykstra. The Interstate, Danville, Illinois. $3.50. 808 pp.; ill. 1949.

This is an elementary textbook describing the common ailments of livestock. Prevention of disease through good sanitation, management, nutrition, and breeding practices is emphasized. The author's basic thesis, reiterated in the Preface and many, many times throughout the text, is that treatment of animal disease requires the services of veterinarians. I find no warning that the veterinarian is often unable to prescribe effective treatment.

Misspellings are inexcusably numerous. "Undaient" for undulent. The illustrations of buckhorn and garlic have been interchanged (pp. 381 and 383).

T. C. BYERLY

BACTERIAL AND VIRUS DISEASES. *Antisera, Toxoids, Vaccines and Tuberculins in Prophylaxis and Treatment.*

By H. J. Parish. E. & S. Livingstone Ltd., Edinburgh; [Williams & Wilkins Co., Baltimore]. $2.75. 168 pp. + 5 pl.; text ill. 1948.

The sub-title describes much more definitely than the main title the content of this little book. It is written in the form of a handbook and represents a ready source of essential information concerning prophylactic preparations, and antisera as used for therapeusis. The information includes methods used for preparation of the antiserum or vaccine and directions for its use. Information on a few diagnostic reagents, mainly for skin tests, is also included.

Although the Preface states that this work presents the essential principles of immunology and their practical application in human medicine, it is considerably more limited in scope than that statement indicates. Several pages are devoted to the tuberculin test but the skin test for brucella sensitivity is mentioned in only a few lines and then only in relation to the use of brucella in treatment, without mention of the diagnostic value of the skin test. No reference to the Frei test for lymphogranuloma venereum, and no discussion of the use of pneumococcus polysaccharides either in prophylaxis or for skin tests could be found.

The illustrations are scanty but portraits of 6 pioneers in immunologic studies of infectious disease add to the interest of the book. It would have been valuable to indicate the specific contributions of these men, although this can be found by reference to a final chapter, a tabulation of milestones in the development of immunologic studies and immunologic reagents of disease. Six illustrations in color from the *Atlas of Bacteriology* by Low and Dodds are included. These depict stained smears of various bacteria; although decorative, it is questionable whether they contribute to achieving the purpose of the book. The index is adequate and the book is convenient for quick reference to the subjects covered.

F. B. GORDON

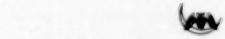
THE EPIDEMIOLOGY OF HEMOLYTIC STREPTOCOCCUS *During World War II in the United States Navy.*

By Alvin F. Coburn and Donald C. Young. Williams & Wilkins Co., Baltimore. $4.00. x + 229 pp.; ill. 1949.

Under the conditions of training at large naval installations during World War II there were reported at least 1,000,000 cases of streptoccal respiratory tract diseases, over 50,000 cases of scarlet fever, and over 40,000 cases of rheumatic fever, heart disease, and acute polyarthritis. In contrast to these extremely high scarlet fever morbidity rates within naval training

centers, the annual rates per thousand of civilian population during the same period averaged about 1.3 from the years 1943 to 1945. This staggering loss in man days to streptococcal disease emphasizes the importance of the problems of control and prevention of such respiratory tract infections. Coburn and Young have in detail presented in their monograph the mechanisms of spread of *Streptococcus hemolyticus*, the introduction of mass therapy, the development and spread of sulfonamide resistant strains in training camps throughout the nation, and the role of dust contamination on its spread. This monograph will be of special interest to serious students of the general problem.

DAVID B. TYLER

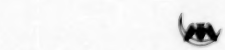


BRUCELLOSIS. *A Symposium under the Joint Auspices of National Institutes of Health of the Public Health Service (Federal Security Agency), United States Department of Agriculture, National Research Council. September 22–23, 1949, Bethesda, Maryland.*

The American Association for the Advancement of Science, Washington, D. C. $4.00. vi + 271 pp.; ill. 1950.

This monograph consists of 24 papers by experts on the subject of brucellosis. The papers cover various aspects of the subject: the cultural and physiological characteristics and variation and chemistry of the causative agent, and the diagnosis, immunology, therapy, epidemiology, and control of the disease in man and in other animals. The book is a valuable contribution, since it is an authoritative summary of the present status of our knowledge of a disease of great economic and public health importance, and worldwide in geographic distribution. Also, the volume encompasses in compact form a considerable body of information, much of which has been published rather recently in a multiplicity of places, times, and languages, and is consequently not all easily accessible. It will undoubtedly be useful as a source of basic information for some time to come.

HARRIETTE D. VERA

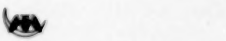


THE DIAGNOSIS AND TREATMENT OF ENDOCRINE DISORDERS IN CHILDHOOD AND ADOLESCENCE.

By Lawson Wilkins. Charles C Thomas, Springfield, Illinois. $13.00. xx + 384 pp.; ill. 1950.

This book was written especially for those interested in clinical medicine. Endocrine disorders have been distinguished from those conditions which resemble them, and diagnostic procedures have been discussed to enable a more specific limitation of the hormonal disturbance. Several chapters have been utilized to explain the physiology and interrelationship of hormones involved in the clinical disorders. This has been extremely well done in a relatively simple and clear manner. The chapter on Endocrine Relationship and Their Influences Upon Growth and Development is particularly fascinating; the accompanying chart helps tremendously to clarify a complex problem. Methods of endocrine study and diagnosis have been carefully explained. History, physical examination, growth and development evaluation, with more excellent charts, are of fundamental importance. Clinical, Bioassay and Chemical tests, their use and interpretation have been fully described. The remaining chapters have been arranged either according to symptom complexes or diseases of a particular gland. The material has been presented in a manner both interesting and easy to understand. Numerous charts and illustrations again help to simplify a subject which has too long been shrouded in mystery.

WILLIAM M. SEABOLD



PARENTERAL ALIMENTATION IN SURGERY *With Special Reference to Proteins and Amino Acids.*

By Robert Elman. Paul B. Hoeber, New York and London. $4.50. xxii + 284 pp. 1947.

Though the material covered in this monograph includes only the period through 1945, this book represents even at the present writing a most valuable and worthwhile contribution. The presentation is clear and logical, fundamental concepts are described where necessary, pertinent historical developments are not neglected, and the author has not restricted himself to consideration of surgical problems but has brought in more strictly medical problems wherever the need was indicated.

In the Introduction a brief historical review of parenteral alimentation is given. The second chapter describes the indications and methods for the parenteral administration of fluids. It is pointed out here, and emphasized again later, that patients recovering from surgical procedures need not be starved; amino acid or protein solutions with glucose and salts can be given intravenously. This chapter is concluded by remarks on the effects of such intravenous injections on the cardiovascular and pulmonary systems and on intracranial pressure. The third chapter is on water and electrolyte requirements. This includes excellent sections on dehydration and on acid-base equilibria and disturbances thereof. Caloric, vitamin, and protein needs are described in the next 3 chapters, with pertinent remarks on the normal and disturbed metabolism of proteins and amino acids. There follow discussions of the clinical manifestations of protein deficiency, and of plasma and amino acid transfusions. The last chapters present the author's conclusions as a summary of the clinical results obtained. This

book should be of value not only to surgeons but also to those who deal with disturbances of protein metabolism in medical wards or in laboratories.

F. P. CHINARD

INTESTINAL INTUBATION.

By Meyer O. Cantor. Charles C Thomas, Springfield, Illinois; Blackwell Scientific Publications, Oxford; Ryerson Press, Toronto. $7.50. xiv + 333 pp.; ill. 1949.

This discussion of the clinical use of gastro-intestinal tubes is mainly for the surgeon and clinician. The book includes chapters on the history of the invention and development of such tubes, on the normal anatomy of the gastro-intestinal tract, on intestinal physiology, and on the effects of distention.

BLOOD AND PLASMA TRANSFUSIONS.

By Max M. Strumia and John J. McGraw, Jr. F. A. Davis Company, Philadelphia. $7.50. x + 495 pp.; ill. 1949.

The vital importance of an adequate supply of blood to hospitals and to the Red Cross is demonstrated everyday by news in the headlines. This book describes procedures for the handling of blood from the bleeding of the donor to the administration of the blood to the recipient. The emphasis is on the technical and practical aspects of blood and plasma transfusions.

The essentials on blood groups and types (including the Rh-Hr types) and on their determination precede a chapter on the indications for transfusions in such clinical conditions as shock, burns, hypoproteinemia, anemias, and cerebral edema. There follow descriptions of the techniques and apparatus used in the collection, storage, and administration of blood and plasma, and a section on the changes occurring in stored erythrocytes. Full details are given on the organization and operation of a blood bank. There is also an extensive section devoted to transfusion reactions and the possible transmission of disease by donor blood. Chapters on the preparation of crystalloid solutions for infusion and on specific technical aspects (care and sharpening of needles, sterilization, freezing and drying plasma, plasma volume estimations) close the book.

Bare mention is made of the use of human serum albumin, of globin preparations, or of the so-called "blood substitutes" such as dextran, polyvinylpyrrolidone and gelatin. However, those who seek an authoritative, clear, and practical discussion of blood and plasma transfusions and of the handling of blood will find it in this book.

F. P. CHINARD

HAEMOLYTIC DISEASE OF THE NEWBORN.

By M. M. Pickles. Charles C Thomas, Springfield, Illinois. $4.50. x + 181 + 6 pl.; text ill. 1949.

This monograph discusses the historical evolution of the disease, the basic facts with regard to Rh antigens and antibodies, their relation to hemolytic disease and the mechanism of immunity, the pattern of the disease, its treatment and sequelae. It is particularly designed for the serologist, hematologist, and obstetrician. A bibliography of approximately 400 papers chosen for discussion affords an excellent reference source to the literature on the subject. The author and subject indexes are adequate.

DAVID B. TYLER

RECENT ADVANCES IN CHEMOTHERAPY. *Third Edition. Volume I.*

By G. M. Findlay. Blakiston Co., Philadelphia. $7.50. x + 625 pp. 1950.

The present edition of this treatise is divided into 4 volumes. The first considers the chemotherapy of scabies and of helminthic and protozoal diseases with the exception of malaria; the second is devoted entirely to malaria; the third deals with the chemotherapy of bacterial, rickettsial, and virus infections; the fourth contains a survey of the sulfonamides and antibiotics, with a discussion of the general principles of chemotherapy. So vast has the scope of chemotherapy become that it is necessary to provide 4 books to discuss even briefly recent advances in this field. The author predicts in the Preface that "so rapid are the changes that ten years hence it will be surprising if many of the antibiotics now in use are still being employed."

The subjects of Volume One are very adequately treated by the author. The references for each chapter are exhaustive in coverage of the material. The author and subject indexes are likewise quite complete, covering 48 pages. The volume is an authoritative reference source and an excellent contribution. Findlay has succinctly pointed out the 2 main factors which act as brakes on the progress of chemotherapy: the present unsatisfactory classification of bacteria and the confusion that results from the multiplicity of names given by national pharmacopeial committees, proprietary firms, and non-official compendia. The attempt which the World Health Organization is making to tackle this very complicated problem will win the praise of pharmacologists, clinicians, and chemists alike.

C. JELLEFF CARR

ANTIBIOTICS.

By Robertson Pratt and Jean Dufrenoy. J. B. Lip-

pincott Co., Philadelphia, London, and Montreal. $5.00. xii + 255 pp. + 2 pl.; text ill. 1949.

The purpose of this book has been to present in a succinct, integrated plan the facts and principles of fundamental and permanent value relating to the antibiotics. The authors have achieved their aim of presenting in a concise form an easily read account of many of the technical details of this rapidly expanding field. The first 4 chapters consider the concept of antibiosis, the industrial production of antibiotics, and antibiotic spectra. Penicillin, streptomycin, chloromycetin, aureomycin, polymyxin, tyrothricin, and miscellaneous antibiotics are considered in separate chapters. An extensive review of the mechanisms of antibiotic action is set forth in Chapter 11. Chapter 12 gives Retrospects and Prospects in antibiotic therapy. For those desiring a coherent picture of this subject this volume can well be recommended.

C. JELLEFF CARR

LA STREPTOMYCINE ET SES APPLICATIONS THÉRAPEUTIQUES (*Principalement dans la Tuberculose.*)

By C. Levaditi. Presses Documentaires, Paris. 350 fr. (paper). 218 pp.; ill. 1947.

This volume is a review of the use of streptomycin in the treatment of tuberculosis in experimental animals and in man. The chief portion of the text that may be of interest to bacteriologists and clinicians in the United States is the one dealing with studies against bacteria conducted in vitro. Twenty black-and-white photographs illustrate the effects of streptomycin on a number of bacteria, and there are 16 photographs of animal and human tissues prepared for histopathologic study. The remainder of the text appears to have been more completely covered in readily available treatises in English.

C. JELLEFF CARR

MECHANISM AND EVALUATION OF ANTISEPTICS. *Ann. N. Y. Acad. Sci., Vol. 53, Art. 1.*

Edited by Herbert L. Davis; 41 other contributors. The New York Academy of Sciences, New York, $3.00 (paper). 219 pp.; ill. 1950.

A review with an extensive bibliography of the mechanisms of action of antibiotics, antiseptics, and disinfectants, comprising 24 papers presented before the Section on Biology of the N. Y. Academy of Sciences in October, 1949. Consideration is given to assay methods and Food, Drug, and Cosmetic Act regulations of antibiotics and antiseptics.

ORAL VACCINES AND IMMUNIZATION BY OTHER UNUSUAL ROUTES.

By David Thomson and Robert Thomson; assisted by James Todd Morrison. Published for the Pickett-Thomson Research Laboratory, London, by the Williams and Wilkins Company, Baltimore. $11.00. xi + 329 pp. 1948.

The authors have compiled a review of the literature and added their own comments on oral vaccines and vaccines administered rectally, intranasally, intratracheally, by instillation into the conjunctival sac, and through inunction into the skin. About 250 pages are devoted to oral vaccines, about 40 to vaccines administered by other routes. The text was first prepared for publication in 1936, information from the literature of the period from 1936 to 1947 being added later. Some of the diseases discussed have now been brought under control by the use of antibiotics e.g., scarlet fever, gonorrhea, and pneumonia so that vaccination for these is no longer of much practical importance. In the case of tuberculosis, however, the converse is true, as there has been a recent decided upswing in interest in vaccination, especially with the Bacillus of Calmette and Guerin. The volume should be a useful reference book for research workers interested in vaccination, or in immunity in general. The bibliography is extensive; there are author and subject indices.

HARRIETTE D. VERA

PERIODONTIA. *A Study of the Histology, Physiology, and Pathology of the Periodontium and the Treatment of its Diseases. Second Edition.*

By Henry M. Goldman. C. V. Mosby Co., St. Louis. $12.50. 611 pp.; ill. 1949.

This is a comprehensive and beautifully illustrated book about diseases which affect the investing and supporting structures of the teeth. In this rapidly growing and widely expanding field it is not surprising that the interpretations of x-rays and other observations as well as the procedures recommended differ at some points from those of other writers.

The first chapter describes and illustrates the normal periodontium and its relation to the dentition. The second chapter provides an extensive account of the histopathology of the periodontal diseases. Although written in an orderly and convincing style, it presents no ideas other than those of the author and those with whom he seems to agree. A reference list of 79 titles is supplied, but the 21 authors named in the section are not keyed to specific citations. Chapter 3 presents briefly and fairly some of the views held by various workers on the etiology of periodontal disease. Chapter 4 is devoted to Experimental Pathology, with clear accounts of work done and a good reference list.

The next 2 chapters describe and justify the author's methods of examination and outline his diagnostic procedures.

It is the remaining portion that seems most successful and most useful. The author tells the practitioner "when," "where," "what," and "why" in a convincing and definite way. This is certainly a valuable book for everyone in the practice of dentistry.

JOHN A. CAMERON

HELPFUL HINTS TO THE DIABETIC.

By William S. Collens and Louis C. Boas. Charles C Thomas, Springfield, Illinois; Blackwell Scientific Publications, Oxford; and The Ryerson Press, Toronto. $3.00. x + 135 pp.; ill. 1949.

The title describes very aptly the nature of this book. It will answer all the questions a diabetic person is likely to seek information about, and it will call attention to a lot of perhaps unsuspected side issues, such as insulin shock or insulin allergy, or complications such as arteriosclerosis. It is a complete and admirable guide.

CANCER.

By Beka Doherty. Random House, New York. $3.00. xiv + 327 pp. 1949.

This is a well-written book by a newspaper woman discussing the present status of research in cancer, its detection, treatment, and possibilities for cure. It is especially designed for the general reader.

INTRODUCTION TO NEUROPATHOLOGY. *First Edition. By Samuel Pendleton Hicks and Shields Warren. McGraw-Hill Book Company, Inc., New York, Toronto, London.* $10.00. xiv + 494 pp.; ill. 1950.

This volume is a valuable addition to the medical literature. According to the authors, their aim is to "introduce the fundamentals of disease process in the nervous system to medical students and to trainees in the neurological specialities and in pathology" and to "stimulate an interest among general pathologists and specialists in the fields of nervous and mental disease toward a closer correlation of their respective view points."

Until recently there has been a tendency for the general pathologist to neglect or overlook pathological changes in the brain. The material covered in this book facilitates the work of the general pathologist who wishes to include neuropathology in his routine work instead of leaving it to a specialist. The text is compact and beautifully illustrated. There are valuable illustrative tables and schema which provide a quick means for complicated differentiations and correlations. Adequate bibliographies are given on every subject.

The subject matter covers virtually every field of neuropathology, but the authors' emphasis is varied. Some aspects of neuropathology are described from every facet, while other subjects are dismissed with a superficial word or so. The first chapter concerns reactive patterns in nervous tissue and provides an excellent foundation for the specific syndromes which follow. Other excellent chapters are those concerning circulatory disturbances and cerebrovascular accidents, brain metabolism, and mechanical injuries to the nervous system (including birth injuries and tumors). The survey of tumors is especially valuable because of excellent correlations with embryology, incidence, and prognosis, as well as graphic descriptions and illustrations of all primary and metastatic intracranial, spinal, and peripheral nervous tumors.

The main fault of this volume is that much of the material is elementary and abbreviated. Less space is allotted to certain diseases than is found in a standard textbook of general pathology. This is true not only of rare diseases, but of conditions encountered as frequently as Parkinson's disease and lead poisoning. Furthermore, many of the correlations with pathogenesis, the clinical picture, and general systemic pathology are too superficial to be of any practical value. Because of these faults this book will be of little value to the specialist in neuropathology. On the other hand, it is unique in providing the medical student, the internist, and the general pathologist with an excellent survey of neuropathology and a ready reference book in this field.

ELLA H. OPPENHEIMER

LIFE STRESS AND BODILY DISEASE. *Research Publications—Association for Research in Nervous and Mental Diseases—Volume XXIX. Proceedings of the Association, December 2 and 3, 1949, New York.*

Editorial Board: Harold G. Wolff, Stewart G. Wolf, Jr., and Clarence C. Hare. Williams & Wilkins Co., Baltimore. $15.00. xxiv + 1135 pp. + 2 pl.; text ill. 1950.

This volume consists of 70 papers read at the 1949 annual meeting of the Association for Research in Nervous and Mental Diseases. Actually, what we find here is psychosomatic medicine, with a shiny face and all dressed up in its Sunday-go-to-meeting clothes. Following each paper is a fair sample of the "discussion" it provoked. Now, the "discussion" at the meetings of this association is the sole function of a "commission" of about a dozen or so scientific "peers." A question may be raised from the floor by an ordinary member of the audience provided it is polite and pleasing but, apparently to assure this, such questions must be written out and dispatched by courier, either to the chairman, or to some member of the "commission" who, in turn, will read the question should he deem it a

proper one. It may be of interest to those investigators who are psychosomatically inclined that such procedures have been reported to produce in many of the more restless and critical members of the audience a transitory but definite ringing in the ears.

DAVID B. TYLER

SOVIET PSYCHIATRY.

By Joseph Wortis. The Williams & Wilkins Co., Baltimore. $5.00. xvi + 314 pp. + 1 pl. 1950.

This book closes with a plea for scientific interchange between the countries of the world in spite of the recognized difficulties placed in the way by the political situation that now obtains. This would be much easier if all scientists could achieve an attitude of search for truth independent of the events of the world about them, an ideal which we endeavor to follow, admittedly almost universally unsuccessfully, but which is violently heretical from the point of view of the Soviet philosophy—as may be seen particularly in the material of the appendix of this book. Perhaps if there were some efficient (and trustworthy) abstracting service for the foreign literature which could recover the grain of science while discarding the boring chaff of wordy references to the basic philosophic authorities, we could more easily discover what our colleagues can bring forth in spite of the narrow channels along which they are constrained to think, or at least to write. The warning for the non-Soviet scientist is very clearly to be seen in this book. We must be careful not to allow a situation to arise wherein our own work is so bound by profuse philosophic verbiage of shallow democratic idealism that the freedom to range over the whole of human production in our search for truth becomes constricted.

In reporting on Soviet psychiatry, Wortis has been limited to reviewing the literature, a restriction he regrets but could not overcome. This factor, however, makes it necessary to be very cautious in interpreting the reports. There is no reason to believe that Russians are any less likely to make themselves "look good" in their writings than we Americans. While comparisons based on numerical data might obviate this difficulty, such data can only be useful when the denominators of population, as well as of definition, time use, etc., are known. Wortis has not been helpful in this regard. Nowhere in the book is there a reference to the total population of the country though occasionally figures are reduced to rates. A section on the vital statistics and geography of the U.S.S.R. early in the work would have made interpretation much easier.

Because of these difficulties, the work is most valuable in revealing Soviet ideals, particularly in the organization of psychiatric preventive and treatment services. These are indeed admirable. There are easily available clinics for all sorts of psychiatric care, both in- and out-patient. The school children are all to be evaluated and assigned to classes and activities most suited to them; occupational therapy of a practical and productive sort is to be available to all who need it; industrial mental hygiene is to be available to all. Alcoholism is to be treated as an illness, though the patient remains legally responsible unless actually psychotic. Forensic psychiatry is highly developed, and dynamic considerations are a part of the records of cases quoted in the book. Psychotherapy is available and used, though in general treatment by physiological means such as the shock therapies appears more acceptable. Psychoanalysis and other types of long-term therapy are not used, partly because of political-philosophical reasons (discussed below) and partly because practicality appears to be a fundamental consideration.

Freudianism and all other psychological systems which ascribe primary psychological functions to the person are incompatible with Soviet philosophy at the present moment, because it is assumed in them that the individual is not completely modifiable by environmental contacts but has some capacity for individual organization in the selection and evaluation of these contacts. Man becomes a peculiarly flat, bound-by-the-immediate-moment sort of creature, largely without the "envelope" (Plant) through which the experiences he meets are screened and are given values.

One cannot but be impressed by the fact that even in this sympathetic presentation of Soviet psychiatry "must," "shall," and other authoritarian words occur very frequently. Those tremendous reversals of basic concept that have taken place in Soviet psychiatry and psychology wherein black becomes white almost overnight by official decree, make one feel a great deal of sympathy for professional colleagues who live under such a regime. Wortis stresses the fact that scientific controversy is approved and encouraged in the U.S.S.R., and that the defeated party in a controversy is not punished for having been on the wrong side. While this *may* be true in some fields, the defender of a cause is apparently not able, after a decision, to speak further in favor of his defeated principle, or at least few have done so obviously enough for Wortis to be able to find their writings.

PAUL V. LEMKAU

FURTHER STUDIES ON THE ETIOLOGY AND SIGNIFICANCE OF CONGENITAL CRANIAL OSTEOPOROSIS (CRANIOTABES) I. *Monog. Soc. Res. Child Devel., Ser. No. 47, Vol. XIII, No. 2, 1948.*

By Elena Boder. Child Development Publications, Northwestern University, Evanston, Ill. 75 cents (paper). 30 pp. 1949.

PSYCHOLOGY AND ANIMAL BEHAVIOR

PHYSIOLOGICAL PSYCHOLOGY. *New Second Edition. McGraw-Hill Publications in Psychology.*

By Clifford T. Morgan and Eliot Stellar. McGraw-Hill Book Co., New York, Toronto, and London. $5.00. x + 609 pp.; ill. 1950.

In accordance with the rapid development of physiology and psychology, the 2nd edition of C. T. Morgan's well-known, comprehensive book of 1943 is completely rewritten with the assistance of Eliot Stellar. Some parts have been cut down and others are added, e.g., chapters on Color Vision, Motor Learning, Behavior Disorders, and Electrical Activity and Behavior. Accordingly the valuable bibliography is enlarged substantially. Thus quite a new book has resulted, the manifold content of which can only be reported very imperfectly.

The treatise starts with a discussion of the functions of neurons and of the peripheral, central, and autonomic nervous systems, including the dependence upon them of the metabolism and especially of the hormones. Then spatial vision, brightness vision, color vision, hearing, skin senses, and somesthetic mechanisms are treated clearly and critically, corresponding to the current state of the science. The limits of present knowledge are always marked distinctly, a fact of great importance for all future research. It is expressly admitted, for instance, that the cortical representation of the retina is not exact enough to explain sufficiently the acuity in human and animal vision. Farther on, the authors point out that Hecht's plausible photochemical theory of brightness vision does not take into account the marked effect of participating nervous processes. The 2 types of pain sensation, prick pain and dull pain, are now separated distinctly, and the hypothesis that extreme intensities of other sensations may cause pain is more or less wholly rejected. In order to explain thermal sensitivity, a plausible synthesis of the theories of Jenkins (free nerve endings as thermal receptors), of Bazett (thermal gradients), and of Nafe (connection of thermal receptors with blood vessels) is proposed.

The second half of the book is concerned with the motor system, the reflexes, coordination, emotion, and the analysis of instincts and learning. Here, too, each chapter gives an excellent account of our present knowledge. With regard to actual questions we may only refer to the critical discussions of spinal conditioning, of biochemical factors in learning and intelligence, in visual generalization, and in the origin and signification of electroencephalograms. The authors have taken no notice of von Holst's criticism about the conception of reflexes and also some other results of European biologists are not mentioned. We miss, for instance, any reference to Lorenz' and Tinbergen's important analysis of instinctive behavior. Apparently, this depends upon the tendency of the book to consider first the physiological basis. It would therefore perhaps be possible to ask whether it would not be more correct to have chosen the title "Psychological Physiology" (all the more since in a book on "psychology" a discussion of the problems of association of ideas, of processes of volition, and of the problem of the self could be expected). By this remark I want only to outline the character of the present book, not to criticize. For on the whole, it is most admirable to master the enormous material of our present knowledge and to discuss it in such a comprehensive, exhaustive, and critical manner. This standard book will be indispensable for every physiologist and every physician, for every psychologist and every zoologist, and it will be an excellent basis for the student.

B. RENSCH

PSYCHOLOGY. *A Biosocial Study of Behavior.*

By E. Terry Prothro and P. T. Teska. Ginn & Co., Boston. $3.75. x + 547 pp.; ill. 1950.

This is an introductory textbook in psychology, designed to meet, according to the authors, both the need of the beginning student to know the practical issues of psychology and the instructor's desire for providing a conception of the scope and methods of the subject and its place in science. The book proceeds in an orderly and readable fashion to meet these objectives by covering the usual topics found in elementary textbooks. Two introductory chapters cover the background of psychology and the scientific method; 5 chapters are devoted to the individual and his drives and motives; 5 to the biological aspects of behavior (including a chapter on the organs of adjustment in lower animals); there follow a chapter on observing and one on learning. The book concludes with 3 chapters on the topics of efficient learning in college, intelligence, and vocational guidance. The authors manage to maintain a non-dogmatic presentation throughout, so that the student ought to obtain an integrated, well-rounded introduction to the field of psychology. The book is well illustrated, and contains a bibliography and combined subject-author index.

H. J. BOND

PSYCHOLOGY. *Second Edition.*

By Floyd C. Dockeray and G. Gorham Lane. Prentice-Hall, New York. $3.75. x + 564 pp.; ill. 1950.

A revision of an elementary college textbook in general psychology. The treatment begins with scientific methodology in psychology, considers the relations of heredity and environment, deals more extensively with learning, memory, and thinking, then with motivation and emotion, and concludes with sections on

perception and individual variations in abilities and personality. Each chapter has at the end a summary and a group of review questions. The book includes a list of available visual aids, and both author and subject indexes.

PSYCHOLOGICAL PROBLEMS IN MENTAL DEFICIENCY. *By Seymour B. Sarason. Harper & Bros., New York.* $5.00. xii + 366 pp. + 8 pl.; text ill. 1949.

Here is a very welcome book on a neglected field. The author has covered the ground thoroughly, discussing the criteria of mental deficiency, classification problems, brain injury diagnosis, and problems in test interpretations, including projective techniques. He has valuable words of advice concerning psychotherapy in such cases and for their families. It is a useful book.

WENDELL MUNCIE

THE PHYSICAL BASIS OF MIND. *A Symposium. Compiled by Peter Laslett. The Macmillan Co., New York; Basil Blackwell, Oxford.* $1.00. viii + 79 pp. 1950.

Ever since Aristotle men have been asking: What is the Mind? Where is it? How does it work? To get a modern answer to these questions, a layman, Peter Laslett, asked 2 physiologists, Sir Charles Sherrington and E. D. Adrian; 2 anatomists, Le Gros Clark and S. Zuckerman; a psychiatrist, E. T. O. Slater; 2 neurosurgeons, W. Russell Brain and Wilder Penfield; and 3 philosophers, Viscount Samuel, A. J. Ayer, and Gilbert Ryle, to discuss their views on the subject. The discussions took the form of a series of talks sponsored by the British Broadcasting Company. This little book is the printed record of those talks. Because of the audience to which they were addressed, the lectures are in non-technical, easily understandable language.

The scientists have briefly summarized here the present status of research on the central nervous system and the brain and their function in such behavior as sensing, perceiving, learning, thinking, and remembering. The gist is that we know precious little about what goes on in the nervous system when we carry on these complex kinds of behavior. Further, the scientists are generally agreed that they do not know what Mind is. It remains for the philosopher, Ryle, to put his finger on the crux of the problem. The question, What is Mind?, is a word puzzle, created by philosophers, as a kind of mental exercise. It falls into the same category as the question, What is a centaur? Mind and centaur are words devised by men to refer to fictitious things, and, as such, they have no place in the vocabulary of modern science. Men think, they feel, they sense, they learn, and these processes are legitimate ones for scientific inquiry. But there is no such *thing* as Mind.

This is an interesting little book. It is easy to read, and you will probably find the time needed to read it well spent.

A. CHAPANIS

THE CONCEPT OF MIND. *By Gilbert Ryle. Barnes & Noble, New York (printed in Great Britain).* $3.00. 334 pp. 1949.

This is a scholarly philosopher's and psychologist's account of the mythical basis for the questions posed by Descartes and for the grievous consequences to philosophy and psychology over long years because of it. Taking up to the fullest extent the implications of the Cartesian doctrine, Ryle disposes of it with as neat a hatchet-job as one could expect in scholarly terms, leaving the whole system completely demolished, and satisfactorily so to my view of things. Ryle ends up with an operational behavioristic definition of the problem posed, subscribing essentially to the modern concept that psychology deals with the behavior of people, both overt and implicit, and that such behavior is the only justifiable object of psychological investigation. Mind turns out to be not a static, mythical state or substance, but a kind of operational performance. This is a welcome book, dealing in a final and definitive way with the incongruities and absurdities of the Cartesian dualism. In this sense, his theory is essentially a replica of the psychobiological teachings of Adolf Meyer.

WENDELL MUNCIE

ANALYTICAL PSYCHOLOGY AND THE ENGLISH MIND, *and Other Papers. By H. G. Baynes; foreword by C. G. Jung. Methuen & Co., London.* 18s. x + 242 pp. 1950.

This collection of papers by the late H. G. Baynes is much in the nature of a memorial to the association between Baynes and Jung, and could well be an expression of the regard in which Baynes was held by his wife and his associates and of the regard in which Baynes held Jung. The title is misleading, being the title of one essay only—an essay based on an assumption that there is "an English mind" and that that mind is of the English public-school type. Almost all, if not all, of the essays have appeared previously elsewhere and, taken out of their original setting and put together, they probably do not quite acquire unity, except in the method of treatment of different subjects. It is difficult not to be partisan between the members of the psychoanalytic hierarchy; hence much of the discussion is the dispute of the theologians and dialecticians rather than the reason of philosophers and lacks a good logical basis.

It does not seem to me that Baynes' writings elucidate the thinking of Jung. In many respects quite the reverse is true, for at times the language tends to be pedantic and turgid and it certainly makes use of all the clichés one could expect. Many of the lectures, of course, are dated by their very subject matter. Despite all these defects, the book is interesting to any psychiatrist or psychologist who wishes to compare Jung and his followers with Freud and his followers.

DAVID ROSS

VERSTEHENDE PSYCHOLOGIE (*Erlebnislehre*).

By Hans W. Gruhle. Georg Thieme, Stuttgart. DM 30.00. xii + 622 pp. 1948.

Hans W. Gruhle is a leading psychiatrist who for over 30 years has been the scientific conscience of German psychiatry. This new work is ample proof that his clear and sober style and his critical acumen have not lessened with age. The book contains so great a wealth of material, of stupendous knowledge in many fields, of critical observations, of scientific clarifications, and basic formulations that a fairly adequate review would require several thousand words.

The author emphasizes that the many and different forms and manifestations of the "psyche" can and should be investigated from many angles. Thus: psychology has to do with temporal sequences and their causal connection, and in so far is natural science; psychology investigates the facts and events of psychical life as well as its development; it is idiographic and nomothetic, and so on. Psychology is neither pure natural science, nor does it belong entirely to the field of the theoretical-historical branches of the humanities. In so far as it has to do with the particular category of "Verstehen," i.e., an immediate apprehending of how psychical facts and events and inner experiences are springing from other psychical facts and inner experiences, it is neither natural science nor anything else but only itself. It is this kind of psychology with which the author is concerned throughout this book. It confines itself to the "Verstehen" of psychical phenomena and events and their hanging together. The author tries to avoid all philosophy—although his philosophical erudition is notorious—; he refrains from all values; he is not concerned about "mental contents": he knows that one can investigate thinking only if one thinks something; yet he endeavors to examine not this "something" but thinking itself. Thus, this book strives for an "empty" or "better a pure psychology."

There are 6 main chapters with many subdivisions, of which the following may be mentioned: Phenomenology (consciousness, impulse; "I" quality; etc.); Psychological Understanding—"Einfühlung" (the concept of expression; theory of understanding; motivational understanding); Personality: (character, type; "temperament"; intelligence; dream; eroticism and sexuality); Personality and Environment; Psychology and Special Sciences (philosophy; history; science of religion; occultism; science of art; social sciences; law; language; natural science; therapy; education).

To American readers, and perhaps to the majority of psychologists and psychiatrists in other countries, this book will seem a strange undertaking. At best they may look on it as a magnificent monument of a period of scientific endeavor which has definitely passed. The present generation does not look for a psychology which is a thing all to itself; they want a psychology more alive and practical. They are not afraid but eager to draw freely upon sociology, anthropology, mythology, biology, and other fields for the material of psychology. The psychological orientation is functional and dynamic; it is social and situational, biosocial, or genetic-biographical, or a mixture of all these. Yet I feel that a study of this book might have a sobering influence on those who can overcome some of their own notions or convictions.

WALTER O. JAHRREISS

THE PSYCHOLOGY OF IMAGINATION.

By Jean-Paul Sartre. Philosophical Library, New York. $3.75. viii + 285 pp. 1948.

This volume by the leader of existentialism is very difficult reading. The problems to which he addresses himself would have been more familiar 50 years ago than they are in this age of behavioristic psychology. This is not to say that the problems are meaningless; on the contrary, they are important for the science of psychology. It is, however, necessary if Sartre's views are to have an important impact that his position be communicated clearly to readers. In this respect the book is not successful. It is my suspicion that its obscurity is as much the result of an unwillingness to be clear as it is a result of the profundity of the ideas.

A. L. BALDWIN

STUDIES IN LEADERSHIP; *Leadership and Democratic Action.*

Edited by Alvin W. Gouldner. Harper & Bros., New York. $5.00. xvi + 736 pp. 1950.

Gouldner, a sociologist, considers a leader to be "any individual whose behavior stimulates patterning of the behavior in some group." Leadership is "a *role* which an individual occupies at a given time in a given group." Within this broad conceptual framework of leadership some 30 papers are presented, many of them published for the first time. Some of these contributions deal with types, notably the bureaucrat, agitator, and informal leader. A section on Leadership and its Group Settings includes several papers on leadership

among social classes (business and unions), among minority groups (Jews, Negroes, Italian-Americans, women), and various angles of political leadership. Authoritarian and democratic leadership are contrasted as to their origins and effects, with an admitted bias in favor of the democratic type. A sizable section deals with The Ethics and Technics of Leadership, discussing the problems that leaders face: apathy, planning, innovation, remedial change, and leadership selection and succession.

The editor has assembled a valuable collection of readings. He has chosen wisely from the writings of such men as Lewin, Merton, Warner, Whyte, Leighton, and many others, and portrays well the tendencies both toward unity and diversity in the study of leadership. Gouldner's introduction and frequent orienting "contexts" help to give coherence to the volume and make it serviceable both for classroom use and for the general reader.

S. S. SARGENT

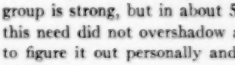
THE INFLUENCE OF THE GROUP ON THE JUDGMENTS OF CHILDREN. *An Experimental Investigation.*

By Ruth W. Berenda. Columbia University Press, New York (A King's Crown Press Publication). $2.25. xvi + 86 pp. 1950.

A monograph on the subject of how individual school children react to group pressures. The author has arranged an ingenious yet simple method for placing an individual at variance with a group of his peers, thus enabling the investigator to see whether the child will conform or stick to his individual conviction. Although it was clear that the individual did frequently succumb to the group, still it was not always the case. The child who followed the group despite his own idea was made quite anxious and insecure.

Mrs. Berenda feels that this study explodes the classical hypothesis that man is a victim of the group and does not evaluate situations objectively. The need to belong, to have the protection of belonging, to a group is strong, but in about 50 per cent of the cases this need did not overshadow an even greater need—to figure it out personally and to stick to one's own solution.

HELEN ARTHUR



CURRENT TRENDS IN THE RELATION OF PSYCHOLOGY TO MEDICINE.

By Wayne Dennis, Robert H. Felix, Carlyle Jacobsen, Robert A. Patton, Yale D. Koskoff, Paul E. Huston, Nathan W. Shock, and Hans J. Eysenck. University of Pittsburgh Press, Pittsburgh, Pa. $3.75. viii + 189 pp. 1950.

This is a symposium consisting of 8 lectures delivered under the auspices of the Department of Psychology in The College of the University of Pittsburgh during February 9 and 10, 1950. Together they make a pattern reflecting the usual current opinions about the interrelationships of the fields of medicine and psychology. All of the lecturers, of course, represent intradisciplinary phases of the respective knowledge areas, and each is a person of sufficient note to entitle him to an attentive hearing. Dennis, of the school that was host for the conference, introduces the topic; Felix, of the United States Public Health Service, discusses it from the point of view of public health; Jacobsen of New York handles the place of psychology in medical education; Patton of Pittsburgh's Western Psychiatric Institute and Clinic writes on experimental psychopathology; Koskoff, the neurosurgeon and consultant at the same Institute, deals with the place of psychology in neurological research; Huston of Iowa considers the relations of psychiatry and psychology; gerontology and psychology is the topic considered by Shock, of the United States Public Health Service; and Eysenck of London provides information about the problem as it exists in England.

For me the book holds only minimal value, being no more than a bare statement of the problem. Actually and essentially, it consists of little more than polite and manneristic mutual back-scratching. After all the compliments have been paid and the social obligations followed to the final ritualistic letter, there still remains a fundamental, living antagonism between psychologists and those practitioners of areas of medicine that fall across both fields. Particularly is this true in clinical psychology. What is needed is a symposium that will get down to the brass tacks of the conflict, face the real issues involved, and settle them once and for all.

ROBERT LINDNER

SYMPOSIUM ON THE HEALTHY PERSONALITY. *Transactions of Special Meetings of a Conference on Infancy and Childhood June 8–9 and July 3–4, 1950, New York. Supplement II: Problems of Infancy and Childhood. Transactions of the Fourth Conference, March 1950.*

Edited by Milton J. E. Senn. Josiah Macy, Jr. Foundation, New York. $2.50. 298 pp. 1950.

The present symposium is one in a series held for the purpose of providing source material for use at the Midcentury White House Conference on the theme: "How can we raise an emotionally healthy generation?" Participants included the broadly multiprofessional membership of the Macy Foundation's Conference on Infancy and Childhood, supplemented by interested authorities in the fields of child care and child study. Three multiprofessional round-table discussions make

up this volume, each based on an initial unpublished paper by one of the participants. With each discussion there is published the final revised version of each initial paper as it was afterward presented to the Fact-Finding Committee of the White House Conference.

The 3 papers and their authors are: Growth and Crises of the 'Healthy Personality' (Erik H. Erikson); Constitutional and Prenatal Factors (M. F. Ashley Montagu); and Toward a Social Psychology of Mental Health (Marie Jahoda). Erikson's paper, together with its discussion, makes up one-half of the book. His final version is a highly concentrated and brilliant organization of the most incisive of contemporary insights into the processes of personality formation and functioning. Montagu's presentation is an extremely lucid, complete, and suggestive review and discussion of the literature to date on the character of prenatal relationships between mother and fetus. Jahoda's outline reflects the undeveloped state of affairs in current thought about relationships between the individual and his environment, and is the least satisfactory of the 3 papers. Characteristic of the thinking and approach of the participants throughout is a strong emphasis on the highly complex "transactional" or "field" nature of the structures and processes under consideration. At the same time, the conference setting of these proceedings serves to dramatize the rich interplay of factors in the matters discussed by pointing up the interactions among the views of participants from many fields.

In addition to the wealth of fact and pregnant hypothesis to be found in this praiseworthy volume, the discussions contain much of value on the pertinent problem of communicating potentially anxiety- or guilt-arousing clinical findings to parents on problems of parent-child relationships. The Macy Foundation has performed an important professional as well as public service in bringing together such a group of experienced workers for the discussion of such a significant and many-sided problem.

ERLING ENG

MENTAL HEALTH THROUGH WILL-TRAINING.
By Abraham A. Low. Christopher Publishing House, Boston. $5.00. 393 pp. 1950.

A collection of excerpts from some of the group meetings of Recovery, Inc., interspersed with lectures by the author which for the most part seem to represent his philosophical beliefs. The Organization does seem to offer a place for psychiatric patients to meet together and discuss their problems. It is suspected that because of this the physician is tolerated, his concepts of mental health notwithstanding.

IVAN D. JUNK

GREGORIO, THE HAND-TREMBLER. *A Psychobiological Personality Study of a Navaho Indian. Reports of the Ramah Project—Report No. 1. Papers Peabody Mus. amer. Arch. Ethnol., Harvard Univ. Vol. XL, No. 1.*
By Alexander H. Leighton and Dorothea C. Leighton, with assistance of Catherine Opler. Peabody Museum of American Archaeology and Ethnology, Harvard University, Cambridge, Mass. $2.50 (paper). xiv + 177 pp.; ill. 1949.

The authors, 2 psychiatrists of the Adolf Meyer school who turned anthropologists, describe the life of a young Navaho who became a "hand trembler," that is, a kind of medicine man, specialized in a particular technique of divination-diagnosis. They interpret this development in terms of the restoration of an "internal equilibrium." The case is observed with sympathy and intelligence. That it is told practically 3 times in succession in almost identical terms is supposedly a new techni.que in the "social sciences." It strikes me as superfluous, and another manifestation of disintegrated thought in our society.

ERWIN H. ACKERKNECHT

HUMAN BIOLOGY

SPEAKING OF MAN.
By Abraham Myerson. Alfred A. Knopf, New York. $3.00. viii + 279 pp. 1950.

Abraham Myerson, who died in 1948 at the age of 67 from coronary disease, was one of the outstanding American psychiatrists of his generation. Between 1930 and 1948, as revealed in letters to his publisher, he tried to write a book incorporating the general results of his professional and life experience. When eventually he came technically to grips with the problem, he died. His daughters-in-law have assembled the fragments and added a fine biographical sketch. The result makes worthwhile reading.

Myerson was technically not a philosopher. He was too restless to be truly wise. But he had a tremendous amount of good "common sense," and was a brilliant writer. His remarks on man and his destiny are, of course, colored by his psychiatric career; they enclose specialized chapters like those on heredity, genius, and sterilization, but in general go far beyond the confines of psychiatry, and are truly human.

Somebody should have eliminated the embarassing fake Latin "homo ferociens," "gregariens," "credu-liens," etc.) from the manuscript. The pretense of knowing foreign languages while being ignorant of them is a minor weakness of the author which he owns in common with most of our educated people. But just because his writing sounds so genuine in many other ways, we would prefer not to know about such minor shortcomings of his.

ERWIN H. ACKERKNECHT

ETHIOPIC DOCUMENTS: GURAGE. *Viking Fund Pub. in Anthropol., No. 14.*

By Wolf Leslau. Editor: Ralph Linton. The Viking Fund, New York. $3.00 (paper). 176 pp. + 12 pl. 1950.

During an expedition to Ethiopia in 1946–47, Leslau collected a grammar and texts in Gurage, a semitic language spoken in a province situated southwest of Addis Ababa, and inhabited mostly by the Chaha tribe. This linguistic material, collected and presented with much skill and scholarship, contains simultaneously a greater number of interesting ethnological data on the life, mores, and religion of the Chaha.

ERWIN H. ACKERKNECHT

SOCIAL ORGANIZATION OF THE WESTERN PUEBLOS. *The University of Chicago Publications in Anthropology (Social Anthropological Series).*

By Fred Eggan. The University of Chicago Press, Chicago. $6.00. xviii + 373 pp. 1950.

This thorough study deals with the Hopi, Hano, Zuni, and Laguna Indians. The author is primarily concerned with two related problems: (1) the nature and functions of the social organization in each of the western Pueblos; and (2) the possibility of classifying these as varieties of a single specialized type of social structure and of explaining the variations in terms of sociological and historical factors. The first part of the book deals with kinship systems and the relations between kinship and other aspects of social structure. The second part explains some of the factors responsible for variations in social institutions in western Pueblo society. Finally the Eastern Pueblos are summarized and interpreted with regard to their Western neighbors. The author's sociological interpretations seem plausible and reasonable. The historical conclusion must of necessity remain hypothetical. It assumes that the matrilineal lineages represent the earliest form of Pueblo social organization. The present volume ranks high in the field of social anthropology.

ERWIN H. ACKERKNECHT

PROBLEMS OF DEVELOPMENT OF DENSELY SETTLED AREAS & SCIENTIFIC POSSIBILITIES FOR INCREASING THE WORLD'S FOOD SUPPLY. *Proc. Amer. Phil. Soc., Vol. 95, No. 1.*

American Philosophical Society, Philadelphia. $1.00 (paper). 91 pp. 1951.

Each of the 2 symposia consists of 4 papers. The first group was presented at the Annual Meeting of the Society, April 20, 1950, and comprised Population Trends in Densely Populated Areas (Alva Myrdal); Population and the Further Spread of Industrial Society (Kingsley Davis); Economic Factors in the Development of Densely Populated Areas (Joseph J. Spengler); and Farmers in a Hungry World (Howard R. Tolley). The second group was given at the Autumn General Meeting, October 26, 1950, and included Chlorella as a Source of Food (H. A. Spoehr); Production of Nutritive Substances from Inedible Carbohydrates (Alfred J. Stamm); On Increasing the Exploitation of Aquatic Resources for World Food Needs (Lionel A. Walford); Genetic Improvement of Food Plants for Increased Yield (Merle T. Jenkins). The unity of theme makes the collection as a whole a most important reference for any biologists who are concerned with human food resources.

HUMAN FERTILITY AND PROBLEMS OF THE MALE.

By Edmond J. Farris. Author's Press, White Plains, N. Y. $5.00. xvi + 211 pp. + 9 pl.; text ill. 1950.

This is a sound book in spite of the fact that when it appeared several advertisements of it in local newspapers once again had the ring familiar to the older generation raised in small towns. These advertisements used to announce the arrival at a second-rate hotel of some great specialist in diseases of the male reproductive tract. These were recalled because the new advertisements somewhat similarly inferred that the reader might be one of the sub-fertile or even sterile males. However, instead of urging the reader to visit some pseudo-specialist, he was urged to read a review of this book in the current *Reader's Digest*. The book *Human Fertility and Problems of the Male* deserves good publicity, for it is written with a reserve its advertisements lacked, and introduces new techniques for the evaluation of male fertility gauged to the skill of the medical profession.

Judged either as a record of what the author has accomplished or as an integrated summary of what can be done toward the solution of infertility in the male under the direction of a physician, this is a good book. Not the least of the author's accomplishment is his understanding of the human problems involved. This shows not only in his work with patients but also in the cooperation he was able to secure from physicians. It strikes the reader most forcibly that a book on this subject about domestic animals would be far bulkier, while references and index, both of which are very good in Farris' book, would cover at least 8 times as many pages. It is not the author's fault that so little work has been done on human fertility. He is to be congratulated for seeing the paucity of material in the field and doing his best to correct it.

Although this book is primarily intended for physicians, biologists and sociologists will also find it useful. Students should be encouraged to read it, for it is well

for them to see the scientific method applied to a field where so much as been speculation or silence.

ROBERT K. ENDERS

STERILIZATION IN NORTH CAROLINA. *A Sociological and Psychological Study.*

By Moya Woodside. The University of North Carolina Press, Chapel Hill. $2.50. xvi + 219 pp. 1950.

This is a report by a well qualified psychiatric social worker on the application—over a period of 17 years—of the eugenic sterilization law of North Carolina. The jurisdiction of this law is limited to persons suffering from mental disease, feeblemindedness, and epilepsy. In addition, many "therapeutic" sterilizations are performed on a voluntary basis, either on the initiative of social agencies upon women of borderline intelligence who cannot successfully be taught to control their fertility, or—on the level of private practice—because the patient asks for it. These "therapeutic" sterilizations are usually done immediately after delivery. Mrs. Woodside's report is of great interest not only to the people of North Carolina, including the professional men and women serving them, but beyond the confines of the State to all persons interested in the development of practicable measures of fertility control in areas where conventional contraception is not easily adopted.

CHRISTOPHER TIETZE

THE SOCIAL AND BIOLOGICAL CHALLENGE OF OUR AGING POPULATION. *Proceedings of the Eastern States Health Education Conference, March 31–April 1, 1949. New York Academy of Medicine, New York. Columbia University Press, New York.* $2.75. xii + 183 pp. 1950.

TRENDS IN GERONTOLOGY.

By Nathan W. Shock. Stanford University Press, Stanford. $2.50. x + 153 pp. 1951.

CONFERENCE ON PROBLEMS OF AGING. *Transactions of the Tenth and Eleventh Conferences—February 9–10, 1948, and April 25–26, 1949.*

Edited by Nathan W. Shock. Josiah Macy, Jr. Foundation, New York. $3.75 (paper). 258 pp. 1950.

The recent burgeoning of interest in the subject of old age is reflected in these 3 books, which appeared within 5 months of each other. All three demonstrate also the determination of the leaders in the new field of gerontology to integrate their thinking from the beginning, for each book deals alike with the biological phenomena of aging, the medical and psychological problems of old people, and the sociological problems posed by an aging population. Clearly gerontology aims to be something new in the sisterhood of the sciences.

To the general reader who wants one book to acquaint him with the field of gerontology, *The Social and Biological Challenge of Our Aging Population* is to be recommended. Brief, crisp, but packed with specific information, the book is easy but profitable reading. Beginning with a discussion, by V. Korenchevsky, of the general problem and the attacks that are being made on it, the book proceeds to examine our changing population structure (C. V. Kiser, V. G. Valaoras), the manifestations of chronic diseases and the possibility of controlling them (J. Oliver, F. J. Tisdall, D. Seegal), psychological problems in age and retirement (E. B. Allen, J. Hochman), and sociological aspects of the age question (K. Davis and J. W. Combs, Jr., E. C. Lindeman).

To the twin fears of physical deterioration and social uselessness that age conjures up in the mind of the average man and woman, the Eastern States Conference addressed itself with particular vigor. In Controllable Factors in the Process of Aging, the late F. J. Tisdall explains the extent to which diet, from conception onward, influences aging, and D. Seegal, in On Longevity and the Control of Chronic Diseases, demonstrates that the heart-bloodvessel-kidney disorders differ from many no longer deadly diseases principally in that no one has yet found out how to cure or prevent them. In The Retirement Myth, perhaps the most forceful essay of the lot, J. Hochman of the International Ladies' Garment Workers Union shows us how forced retirement, far from being a blessing, is often a sentence to despair. In the same vein E. C. Lindeman, in The Sociological Challenge of an Aging Population, makes it clear that we shall have to face some changes in our folkways before the elderly will be really happy among us.

The sustained excellence of this book strongly suggests an able editor—although his name is not on the title page, Iago Goldston evidently deserves a round of applause. But some one should have provided an index.

Trends in Gerontology is a meaty, factual survey of the field. Dealing principally with sociological aspects, but venturing also into medical and biological research, Nathan W. Shock has drawn a comprehensive picture of the current status of the aged and the age problem. He shows the reader, specifically and in some detail, precisely what is being done in this country and abroad about such matters as retirement income, living arrangements, employment, and education. Two chapters even list the gerontological research programs in planning or underway throughout the world; except on the purely clinical side, the total is rather meager.

Through most of the book, Shock confines himself

to facts, reserving opinions to a final chapter in which he proposes a program for developing research on aging. The author feels that institutes of gerontology should be established within universities. Such institutes would reach across departmental lines to concern themselves not only with geriatric matters, but with biological, psychological, and sociological problems as well, and also with teaching for and about the aged. The value of *Trends in Gerontology* is enhanced by a detailed index. Footnotes provide a small but useful bibliography.

The *Conference on Problems of Aging* includes the reports of the 1948 meeting, which was largely concerned with means of advancing gerontology, and of the 1949 meeting, organized around the general theme of longevity studies on laboratory animals. The latter group of papers, particularly those on Life Span Experiments with Rats (R. S. Harris), Pathology of Senescent Animals (J. A. Saxton, Jr.), and Operating Problems (C. M. McCay), contain a vast amount of information of use to anyone interested in the maintenance of laboratory animal colonies. The papers in the former group, however, are given only as short abstracts.

The greater part of the Conference report consists of a transcription of the lively discussions that followed each paper. Apparently a first-class stenographer was engaged, for everything is faithfully set down, including all the strayings from the subject, the requests for repetition because somebody didn't hear, the questions that no one answered. The worth of this sort of presentation is problematical, for the vast range of ideas and facts covered is scarcely accessible except to a very patient page-turner. The lack of an index doesn't improve the situation. Thanks to the amount of material that has been put into it, the Conference report is a bigger book than the other 2 reviewed here, and, although bound in paper, is more expensive. Except possibly to a few specialists in gerontology, however, it is not proportionately more valuable.

FLORENCE MOOG

BIOMETRY

INTRODUCTION TO QUANTITATIVE SYSTEMATICS. *Bull. Amer. Mus. nat. Hist., Vol. 93: Art. 5.*

By Mont A. Cazier and Annette L. Bacon. American Museum of Natural History, New York. 50 cents (paper). iv + Pp. 347–388 pp.; ill. 1949.

This brief discussion of very simple statistical methods used by taxonomists will be valuable chiefly to those who desire a preliminary introduction to methods for studying the variation of populations, and who have no previous acquaintance whatsoever with standard methods.

ANLEITUNG ZU BIOSTATISTISCHEN UNTERSUCHUNGEN. *By Prof. Dr. Franz Alfred Schilder and Dr. Maria Schilder. Max Niemeyer Verlag, Halle (Saale).* DM 6.80 (paper). iv + 111 pp. 1951.

This little manual on statistics covers topics conventionally found in elementary textbooks. Its organization is different from most, however. Statistical formulae are presented in an early chapter, and the bulk of the book is then devoted to detailed analyses of how these formulae are applied to biological problems selected from the literature. Primary emphasis, therefore, is on the practical use of statistics.

A. CHAPANIS

ACCEPTANCE SAMPLING. *A Symposium—105th Annual Meeting of the American Statistical Association at Cleveland, Ohio, on January 27, 1946.*

The American Statistical Association, Washington, D. C. $1.50 (paper). iv + 155 pp. 1950.

This volume consists of the papers and discussion dealing with sampling inspection in industry which were presented at the 1946 annual meeting of the American Statistical Association. The participants in the symposium were mainly statisticians who had been engaged in the application or development of the new statistical inspection procedures during World War II, and the meeting offered them an opportunity to review and appraise their experience. The discussion was divided into two parts: Acceptance Sampling by Attributes; and Acceptance Sampling by Variables.

Acceptance sampling is fundamentally concerned with the risks of making decisions. It is not directly concerned with estimation. In industry it is used to accept or reject lots of some product or to accept or reject processes. In biology it is used to accept or reject hypotheses. In industry, rejection of a lot means return of the lot to the supplier or its submission to 100 per cent inspection. In biology, the rejection of a hypothesis may mean that future research will go in one direction instead of another. In industry there are the "producer's risk" that a "good lot" will be rejected by a sampling plan and the "consumer's risk" that a "bad lot" will be accepted. Sampling plans are usually designed to control one or both of these risks. In biology there are the risks of rejecting a true hypothesis and of accepting a false hypothesis, and in designing his experiments a biologist should consider the extent to which these risks will be controlled.

Biologists who are interested in these problems will find a study of acceptance sampling in industry very fruitful. This is especially true of attribute sampling, for in no other field have the various procedures and problems of acceptance sampling by attributes been so thoroughly discussed. It would be wise, however, to read about industrial acceptance sampling in some

elementary book on statistical quality control before attempting to read *Acceptance Sampling—A Symposium.*

ACHESON J. DUNCAN

DE OMNIBUS REBUS ET QUIBUSDAM ALIIS

SCIENCE NEWS 18.

Edited by J. L. Crammer. Penguin Books, Harmondsworth, Middlesex; [Allen Lane, Baltimore]. 35 cents. 144 pp. + 8 pl.; text ill. 1951.

Contains the following articles of biological interest: Theoretical Implications of Telepathy (Margaret Knight); Plant Hormones and the Control of Flowering (Joyce A. Bentley); The Concept of National Character (Geoffrey Gorer); and Research Report—Insect Eyes, Learning and the Brain, Radioactivity and Algae (A. W. Haslett). A new feature is Correspondence. An index increases the great usefulness of these outstanding publications.

A LABORATORY BOOK OF ELEMENTARY ORGANIC CHEMISTRY. *Third Edition.*

By Alexander Lowy and Wilmer E. Baldwin. John Wiley & Sons, New York; Chapman & Hall, London. $3.00 (paper). xii + 186 pp.; ill. 1949.

A COURSE IN GENERAL CHEMISTRY—*Semi-micro Alternate Form. Third Edition.*

By William C. Bray, Wendell M. Latimer, and Richard E. Powell. The Macmillan Co., New York. $3.00. xvi + 217 pp.; ill. 1950.

INTRODUCTION TO SEMIMICRO QUALITATIVE CHEMICAL ANALYSIS. *Revised Edition.*

By Louis J. Curtman. The Macmillan Co., New York. $3.50. xviii + 391 pp. + 1 pl.; text ill. 1950.

THE THEORY AND PRACTICE OF SEMIMICRO QUALITATIVE ANALYSIS. *Second Edition.*

By G. B. Heisig. W. B. Saunders Co., Philadelphia & London. $3.50. 356 pp.; ill. 1950.

INTERPRETATION OF ORE TEXTURES. *Geological Society of America, Memoir 45.*

By Edson S. Bastin. Geological Society of America, New York. x + 101 pp. + 18 pl.; text ill. 1950.

MODERN OSCILLOSCOPES AND THEIR USES.

By Jacob H. Ruiter, Jr. Murray Hill Books, New York and Toronto. $6.00. xx + 326 pp.; ill. 1949.

Ruiter has written a fairly comprehensive work on the subject of oscilloscopes, a large part of which, however, will be of more interest to people in industry than to the academic biologist. For the latter, who uses oscilloscopes in the laboratory, the sections on the fundamental principles of operation of the cathode-ray tube, power-supply circuits, time base circuits, auxiliary equipment (photocells, signal generations, strain gauges, etc.) and on photographing cathode-ray patterns, will be useful. The latter chapters, on photography, are not complete (certain kinds of camera are not mentioned, for example), but will be most helpful for the information they contain regarding exposures, films and papers, developing times, etc. Could the author be persuaded to do a similar work that would deal specifically with the use of the oscilloscope in biological and medical research?

R. G. GRENELL

AN INDEX OF NOMOGRAMS.

Compiled and Edited by Douglas P. Adams. Published jointly by The Technology Press of Massachusetts Institute of Technology and John Wiley & Sons, New York; Chapman & Hall, London. $4.00. x + 174 pp. 1950.

This is an index to over 1700 nomograms which have been published in technical periodicals. Among the categories included are Mathematics, Physics, Chemical Engineering and Chemistry, Medicine, and Food. There are 27 listings under Medicine and 19 under Food.

UNITED STATES CIVIL DEFENSE.

National Security Resources Board (Executive Office of the President), Washington, D. C.; letter of transmittal by W. Stuart Symington, Chairman. 25 cents (paper). vi + 162 pp.; ill. 1950.

SCIENTIFIC RUSSIAN. *A Textbook for Classes and Self-Study.*

By James W. Perry. Interscience Publishers, New York. $7.50. xxx + 916 pp. 1950.

Much of the difficulty which the English-speaking student encounters in beginning the study of Russian is to be attributed not so much to the complexity of the language as to its completely unfamiliar vocabulary, which lacks easily recognizable cognates in English. All the words are strange, so that the early stage of learning Russian is often like learning a code. This initial difficulty is overcome by Professor Perry's approach. The student is introduced immediately to Russian cognates of English scientific terms and to

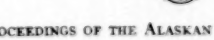
sufficient grammar to be able to read simple text. As a result, interest is aroused and encouragement provided. A thorough and orthodox discussion of the Russian grammar follows this introduction. There are numerous exercises in translation and writing. The Russian text is arranged into units covering such topics as radioactivity, light, etc. Both the words in the text and in the vocabulary are accented, and a list of Russian scientific abbreviations is given. The textbook is complete, thorough, and well conceived. It will be valuable not only for classroom study but also for self instruction.

ISADORE L. DORDICK

THE JEFFERSON PAPERS OF THE UNIVERSITY OF VIRGINIA. *University of Virginia Bibliographical Series, Number 8.*

Compiled by Constance E. Thurlow and Francis L. Berkeley, Jr.; with an appended essay by Helen D. Bullock on The Papers of Thomas Jefferson. University of Virginia Library, Charlottesville, with assistance from the Research Council of the Richmond Area University Center. $5.00 (paper). xii + 343 pp. 1950.

A catalogue of 2341 Jefferson Papers, together with an ndex of 50 pages. The latter makes it possible to locate those papers that might be of interest to scienists. Most of these are grouped under "Agriculture."



PROCEEDINGS OF THE ALASKAN SCIENCE CONFERENCE OF THE NATIONAL ACADEMY OF SCIENCES, NATIONAL RESEARCH COUNCIL, *Washington, November 9–11, 1950. Bull. natl. Res. Coun., No. 122.*

Published by the National Research Council, National Academy of Sciences, Washington, D. C. $2.00 (paper). x + 216 pp. 1951.

The opening remarks and keynotes of the dignitaries are published in full. The scientific papers presented are represented by brief abstracts and summaries. Sessions in anthropology, geography, geology, marine biology, fisheries, and agriculture were held.

TWENTIETH ANNIVERSARY REVIEW OF THE JOSIAH MACY, JR. FOUNDATION.

Josiah Macy, Jr. Foundation, New York. Free upon request. 110 pp. 1950.

This small book reviews the activities of the Josiah Macy, Jr. Foundation since its establishment in 1930. In particular, its support of studies on growth and development, problems of aging, psychosomatic medicine, and medical education and medical practice have been summarized. Special projects of the war years and conferences sponsored by the Foundation complete the *Review.*

REPORTS OF PROCEEDINGS, FIFTH GENERAL ASSEMBLY OF THE INTERNATIONAL COUNCIL OF SCIENTIFIC UNIONS, *Held at Copenhagen, September 14–16, 1949.*

Edited by F. J. M. Stratton. Cambridge University Press, London and New York. 7s. 6d. viii + 249 pp. 1950.

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Theoretical papers are published occasionally, especially when such papers (1) include a critical synthesis of the literature bearing on the theory and (2) are likely to promote further research in a given field.

The article should be written in concise language, yet in sufficiently non-technical form as to be intelligible not only to specialists in other fields but to the general biologist as well. To this end the article should have a general introduction and a summary which enumerates one by one all of the principal facts and conclusions given in the paper. Interpretative diagrams and schemes are very desirable.

Material ordinarily taking the form of footnotes is set in small print and placed in the text and consequently should be written in a style so as to fit readily into the text. Acknowledgments are printed in the text in small type at the end of the article just preceding the List of Literature. Recent issues of the Quarterly should be examined for style as regards (1) section or subsection headings in the text, (2) literature citations in the text, and (3) List of Literature.

The subjects and authors of articles are selected by the Editors and members of the Advisory Board. Unsolicited articles which conform with the objectives of the Quarterly will be considered for publication.

A feature of the REVIEW is the section dealing with *New Biological Books*. In this department the book literature of different countries in the field of Biology is given prompt notice.

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Books for Review may be sent to Dr. H. B. Glass, Department of Biology, The Johns Hopkins University, Baltimore 18, Maryland.

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